Private Finance Initiative and Major Construction Firms in Japan

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ABSTRACT

The Japanese construction industry has long been in recession, and the recession is predicted to continue into the future because both national and local governments lack the necessary resources. The "Private Finance Initiative" (PFI), which utilizes the private sector's technical, financial, and managerial resources to deliver more efficient and higher quality public facilities, has recently been launched in Japan with a special enactment.

The PFI gives substantial opportunities to many Japanese industries, and especially to major construction firms (MCFs), which have collective strength and experience in developing technologies and projects. However, since participants in a PFI project must invest in the project as a whole, only those who can evaluate, manage, and properly assume the involved risks deserve the opportunity.

Based on the background of the Japanese construction industry and the findings from the case studies relevant to the private toll road project or the Japanese PFI, this thesis develops a framework for prospective toll road/bridge/tunnel projects utilizing the Japanese PFI scheme. For the viable types of projects (such as bridges/tunnels or bypass road projects with technically complicated structures and sufficient traffic volume projections), this thesis identifies project structures that are desirable with regard to government supports and risk sharing. A real public-private partnership, which implies joint efforts and initiatives with eagerness to implement the Japanese PFI, is always essential to the development of such a PFI project.

This thesis also proposes two strategies for an MCF to face the Japanese PFI. Differentiation strategy may be attained through financial strength, special talent and experiences, differentiated technologies and patents, and proper equipment. Under certain conditions, such as if the project includes a large potential to develop innovative construction means, MCFs should consider an equity contribution strategy to exploit equitable returns. Simulations of a prospective toll bridge project are also applied in the thesis to test the viability of the framework and the strategies.

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Koji Kato

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Chapter 1. Introduction

1.1. The Advent of the PFI in Japan's Construction Industry

The "***Private Finance Initiative (PFI)***" has recently been launched in Japan. The PFI aims to encourage private entities to invest in a range of public-use projects in order to supply public facilities despite limited government resources, to utilize the private sector's efficiency, and thereby stimulate the Japanese economy. The preliminary approach toward the PFI (not so named yet) was begun in the United Kingdom by the Thatcher government, which adopted "small government" as its slogan. Under the Major government in 1992, the PFI was first proposed and has been proven successful. The Japanese PFI has the potential to greatly improve the efficiency of the Japanese construction industry, to solve a variety of problems in the industry, and to meet economic needs to help Japan recover from economic recession.

A substantial number of Japanese construction companies, or ***general contractors (GCs)***, are ranked among the highest in the world in terms of level of sales. According to ENR[1], five Japanese firms are ranked in the top 7 if sorted by the total revenues[2], whereas only three are in the top 30 (none in the top 10) sorted by international revenues. The main reasons for the scale of Japan's ***major construction firms (MCFs)***[3] are the fact that the domestic construction market in Japan is very large and that there are invisible barriers of entry for foreign GCs.

However, while the MCFs have contributed to Japan's economic growth through the development of public infrastructure, they are now struggling with their financial rehabilitation and the prospective decline of the domestic market. Japanese MCFs, generally speaking, invested huge amounts in real estate during the "bubble" economy

[1] ENR (2000). "2000 Top 225 International Contractors," August 14, 2000 issue of *ENR*
[2] The five are Taisei (rank 1), Shimizu (2), Kajima (3), Obayashi (6), and Takenaka (7).
[3] The term "MCF" in this thesis is more specifically defined in Section 2.2.1.

era of the late 1980s and early 1990s, expecting unlimited increases in the value of real estate and buildings. After the collapse of the bubble, unutilized land and buildings and huge debts have remained for most MCFs. It became apparent that the national and local governments were also short of resources, once the Japanese economic recession occurred, following the bubble's collapse. MCFs need financial restructuring and it is obvious that public works' projects should decline substantially for the next couple of decades. As expected, this is a nightmare for all Japanese MCFs. The MCFs' financial malaise and Japan's reduced public works prospects heighten the MCFs' awareness of the need to restructure their organizations and business strategies.

1.2. The Motivation for the Research

From the viewpoint of an MCF, the motivation for this research comes from a question, "How can an MCF compete and remain profitable in the changing, challenging environment of the Japanese construction industry?" Given the circumstance of the resource deficiency of the national and local governments and economic recession in Japan, the PFI scheme was introduced, being expected to stir the economy. Since the PFI projects have to be profitable entities, or at least more efficient than the projects procured by the traditional delivery method, the entire procedure of the PFI project needs to be improved. The project procedure includes the following elements: grasp of project needs, selection of the project, conceptual design, request for proposals from competitive bidders, detail design, construction, financing, maintenance and operation, and termination. In this integrated scheme, the MCF, with its sole main objective of construction, at first glance seems unable to play a crucial role in the whole project. However, many instances show the opposite result; the MCF often has tremendous potential to make the PFI scheme valuable. To succeed in a PFI project, the MCF, as well as other participants, must work more efficiently than in a conventional project scheme. The experiences in comparable areas should be examined and the MCF's ideal position in the project scheme to gain profits should be analyzed in order to realize the MCF's potential.

1.3. The Objective of the Thesis

A premise of the PFI is that the construction cost of a project should be lowered with the private sector's efficiency if the construction cost is substantial in the project. Then, where should the difference of the construction cost between PFI projects and conventional ones go? Of course, it should go to the people, or taxpayers, by reduced government expense due to one of the PFI's objectives. At the same time, it should go to the private sector, or the developer, as improved cash flows of the project. But, how about the MCF? The MCF would have little incentive to be involved in the PFI project if the MCF works for the project merely as a contractor because accepting squeezed construction prices simply makes the project unprofitable for the MCF as a contractor. Therefore, the MCF must be involved in the developer consortium, which can receive the benefits from the PFI, as a function of the consortium. Then, how should the MCF be involved in the PFI consortium? What kinds of risks should the MCF bear in the consortium for the sake of the benefits?

To find possible answers to these questions, this thesis aims at identifying the Japanese PFI framework and developing some MCF's strategies to face the PFI. In identifying the Japanese PFI framework, *toll road/bridge/tunnel projects* are specifically focused on throughout the thesis in order to make the framework meaningful rather than generalizing the framework, while the PFI Act and relevant official guidelines have a broad scope. To this end, the thesis proceeds with the following structure.

1.4. Structure of the Thesis

The structure of the thesis is shown in **Figure 1-1**. The scope of the thesis is mostly public works and civil infrastructure, and especially toll roads/bridges/tunnels.

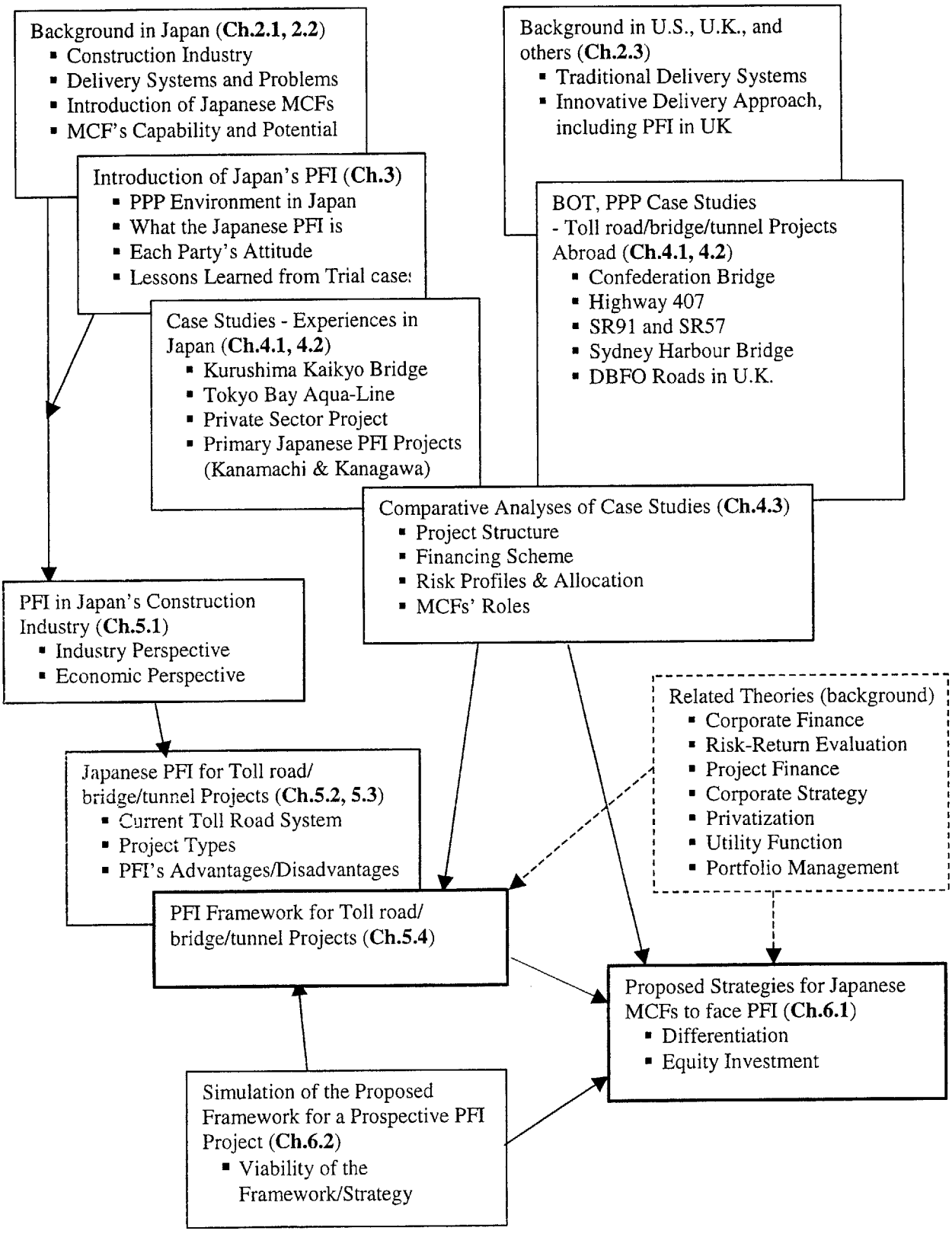

Figure 1-1 Thesis Structure

Chapter 1. Introduction: Chapter 1 introduces the advent of the Japanese PFI with a brief description of the PFI, addresses the objectives of the thesis, and shows the structure and the scope of the thesis.

Chapter 2. Background: Chapter 2 outlines the basic background of the thesis, which is necessary for the discussion in later chapters. Items include the Japanese construction industry, Japanese construction companies, and delivery systems abroad. Some detailed or other background information is allocated in other chapters that discuss relevant topics.

Chapter 3. Introduction of the Japanese PFI: Chapter 3 describes the PFI in Japan and its general characteristics. The main points of the chapter include the purpose for which the PFI was introduced in Japan, discussions surrounding the enactment and issuance of the PFI Act and PFI Guidelines, and some lessons learned from pioneer PFI cases in Japan.

Chapter 4. Case Studies: Chapter 4 examines actual cases procured by various kinds of delivery systems in the PPP context. Analyzed issues in this chapter involve project structures, financial schemes, risk profiles and allocation, and construction firms' roles in each project. Examined cases include two Japanese projects procured under the traditional method, the Confederation Bridge and Highway 407 in Canada, SR57 and SR91 in California, the Sydney Harbour Tunnel in Australia, DBFO toll roads in the U.K., and two pioneer Japanese PFI projects.

Chapter 5. The Japanese PFI and Toll Road/Bridge/Tunnel Projects: Chapter 5 analyzes the PFI in Japan more closely by examining its characteristics in the context of how the PFI works for toll road/bridge/tunnel projects in the Japanese construction industry, utilizing the lessons learned in Chapter 4. Arguments in this chapter center on if the PFI framework is applicable to toll road/bridge/tunnel projects in Japan and how the risks should be allocated or mitigated in the framework.

Chapter 6. Generic Strategies for the Japanese Major Construction Firm: Chapter 6 proposes two generic strategies for a Japanese MCF to face the PFI, together with a simulation of a prospective project. The two generic strategies are differentiation and equity contribution, which contain several fundamental elements. These strategies address how the MCFs can be profitable enough by properly assuming risks surrounding

a project. A simulation for a prospective Japanese PFI project is presented to show the viability of the framework and the strategies, developed in Chapter 5 and proposed in Chapter 6, respectively.

Chapter 7. Conclusion: Chapter 7 summarizes the thesis and concludes with four primary lessons learned through the research.

Chapter 2. Background

2.1. The Japanese construction industry[1]

2.1.1. Overview of the Japanese construction industry

Overview of the Current Construction Industry

Construction is one of Japan's largest industries, involving 600,000 firms and 6,500,000 workers (comprising some 10% of the total workforce). The construction investment in Japan was ¥67.1 trillion in FY1999, which accounted for almost 15% of the Gross Domestic Product (GDP), which is the largest percentage among developed countries.[2] Although public infrastructure has developed intensively since the end of World War II, highway length, park areas, sewage line length, etc. are still far below the averages obtained in other developed countries, and this is one of the reasons why the Japanese construction market has been so huge.

Public works account for about half of the construction investment and the rest is private works. As for only civil engineering works (buildings excluded), public works occupy nearly 80%. Although revenues from public works are less than from private works for most large-scale construction firms, profits from public works are generally more than those from private works: this tendency is more remarkable in civil engineering projects than in buildings projects.[3] More important, most construction firms, large or small, are involved in public works, and the ways they work in public works

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[1] Further information about the Japanese construction industry is described in Section 5.1, where how the Japanese PFI works in the context of the Japanese construction industry is discussed.

[2] Ministry of Construction (2000): Kensetsu Hakusho (Present Status of Land Construction – A Construction White Paper)

[3] For example, Kajima Corporation's gross profit margin in FY1999 was 13.7% for civil engineering projects and 8.1% for buildings projects. During the "Bubble" era, the early 1990s, however, private works were more profitable than public works.

influence the private sector owners. Therefore, public works are important for construction companies, and ***Public-private partnership (PPP)*** projects are thus discussed in this thesis. [4]

The difference between the roles of national and local governments also needs to be considered. While local governments are authorized to spend about 80% of public works, or ¥25 trillion[5], large-scale GCs (general contractors) can and do rarely participate in local works despite the huge scale of local construction market. This is because most of the contract prices of local governments' construction orders are less than ¥100,000,000 [6] and the Kankoju-ho (Public Procurement Act) regulates that local small to medium-sized firms are guaranteed in total to contract some 40% of the construction investment in small projects of each local government,

Trends of the Industry Economy

The construction industry in Japan is currently in recession because of Japan's current economically stagnant situation. The deficient budget of national and local governments deteriorates the industry economy. The increase of social security expenses due to aging population is said to prevent the industry's economic recovery as well as needs for structural reform in public finance in the future.

Although enforcement of the Fiscal Structural Reform Law is currently being suspended to prioritize counter-cyclical measures, needs for the reform remain the same. Michikazu Ozawa, managing director of Research Institute of Construction and Economy, forecasts that spending for public works, on which the construction industry is heavily relying, will decline by 15% in five years and by another 15% in the next five years.[7] Kajima, a major Japanese construction firm, estimates that total construction investments will decline by 8% in three years. These anticipations urge GCs to renew their strategy, although it has not necessarily been important for Japanese GCs to structure the business strategy during the high economic growth period.

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[4] "PPP projects" are used in this thesis to express the comprehensive context of the private sector involvement in public works, where the public and private sectors share the risks and responsibilities of the project.

[5] The national government subsidizes almost half of the local projects, and thus influences local policies.

[6] The average contract price would be less than ¥50 million, assumed from a couple of specific local government's data.

[7] Nikkei BP (2000). "Interview," *Nikkei Construction*, April 28, 2000

Among other recent issues relevant to the Japanese construction industry are restructuring of government agencies (Ministry of Construction, Ministry of Transport, National Land Agency, and Hokkaido Development Agency merged into Ministry of Land Infrastructure and Transport on January 6, 2001), accountability and transparency movement, public works review, IT strategies, and so on, to which Section 5.1 refers in the context of the introduction of the Japanese PFI.

Market Changes – Since there are few mega-projects in Japan after the completion of the Honshu-Shikoku connecting bridges and the Tokyo Trans Bay project (introduced as the Tokyo Bay Aqua-Line project in Chapter 4) in 1998 and 1999 respectively, new and major segments of the market have become environmental and renewal projects. Thus, these projects are among the main focus of PFI scheme. For example, disposals treatment plants are always regarded as prospective PFI projects.

2.1.2. Delivery Systems

Traditional Bidding Method

In the traditional delivery system, the ***design-bid-build (DBB)*** process has been adopted for most public works. The owner government first initiates a planned project with its scope by selecting a design firm, then calls for bids on the project, and finally a successful contractor builds it. In this system, both the design firm and the contractor are selected as the lowest bidders by price only after the competitive bidding. It is mandatory for Japanese governmental agencies, for both the national and local levels, to set an estimated price (***the engineer's budget***), which works as the maximum price to accept, and even the lowest bidder cannot be awarded the contract if its bid price is above the engineer's budget.

In this bidding process, the public sector designates prospective contractors to participate in the bidding according to their rank, which should match the project. Since this designation includes subjective factors and the system has been criticized, it was abandoned in 1993 for the national government's large-scale projects, but it still remains in the local level and for small projects.

How the traditional delivery system has been working in the real world

In the traditional DBB process, opaque and invisible cooperation among the government, design firms (***consultants***), and GCs is a crucial characteristic for most major public works projects in the Japanese system. Consultants are first supposed to design on behalf of the owner (the public sector). GCs have helped consultants/owners in many cases with or without the nominal fee, expecting to get a superior position in bidding as is mentioned shortly. The GC's cooperation is ultimately for the GC's own benefit with the consequence of being awarded the project. The cooperation works also both for consultants because GCs know better how to build and then can design more realistically, and for owners because if the GC is finally awarded the project, it relieves the owner of annoying changes and the fear of an audit. Moreover, public agencies need to develop and estimate construction means and costs without actual experiences. They need GCs' help for both developing new technologies and estimating construction costs. GCs help them with the expectation of being awarded the project in turn. "***Dangou***," called "***Adjustment***" in the industry, has been working as a reward system in many large-scale project cases for major GCs in Japan.[8] Adjustment has just nurtured the environment in which the industry has been allowed to be inefficient.[9]

GCs make their efforts for ***research and development (R&D)*** to accomplish some development for public projects on their own R&D budget in general, while they try to get paid or private customers pay GCs for the R&D costs. This is in compliance with the procurement system, in which GCs don't expect real competition for public projects but need it for private projects. Achievements of R&D usually contribute to efficiency or cost reduction of construction projects, or make projects technically or financially feasible, ultimately resulting in the GC's profit by being awarded the project. What is important in the context of the industry structure is not only that major GCs have technological expertise but also they have integrated skills for R&D, considering the overall concept, design, construction procedure, environmental issues, and financial consequences.

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[8] "Adjustment" differs from collusion, by which the awarded price is raised merely for the firms' profits. Instead, Adjustment cannot raise the awarded price thanks to the engineer's budget, which public agencies set both as the upper limit of the awarded price and as a reasonable price.

[9] Kanemoto, Yoshitsugu, ed. (1999). Nihon no Kensetsu Sangyo (The Japanese Construction Industry)

If delivery systems change, who designs and who researches and develops new technologies? The questions come from the fact that when some government agency comes up with a large, somewhat technically difficult project, Japanese major GCs have helped the government agency by designing it with consideration of construction procedure, or by developing new tools or equipment, almost for free, expecting getting awarded the project by Adjustments. If delivery systems change, since the government might not be able to accomplish a feasible design, the new system should be design-build, or a BOT kind of system that does not require the public sector to go into detail for design or R&D.

Are construction works expensive in Japan due to the traditional system?

Construction works are said to be much more expensive in Japan (some argue about 30% more) compared to the U.S. and European developed nations. This is probably true, but the main reasons are not only the inefficiency of the Japanese construction industry, but also expensive transportation costs and expensive labor and materials costs, which cannot be controlled by the self-effort of the construction industry. Additionally, if the comparison is calculated based on national spending power, quite different consequences are induced that public works prices would be almost same as those of other developed nations. (Kanemoto, 1999)

Problems in the Industry Related to the Bidding System

The Japanese construction industry involves a lot of problematic aspects, which closely and historically influence one another, including the traditional bidding system. Among these are infestation of Adjustments, vague contracts, GCs' substitution for consultants, GCs' other "free" services for the governments/consultants, the GC evaluation and ranking system, the engineer's budget system, and so on. Watanabe et al. analyze the Japanese delivery system by structuring the relations of those aspects with the premise that every aspect is one of the following three in the implementation of public works: a restriction, an objective, or a measure to conform with the restrictions or to attain the objectives. They define that the engineer's budget system is the most important

restriction among those aspects and one crucial source that generates the problems-subsisting structure of the Japanese delivery system.[10]

The engineer's budget is a requirement for any public works provided by an old act called Kaikei-rei (Accounting Act) not only as a budget for the public sector but also as an upper limit price of an awarded bid. This system requires the public sector to precisely estimate a project's construction cost performed by standard means and thereby induces GC's cooperation when both the government and the consultant in charge lack experiences or capabilities for the cost estimation, as is often the case in major public works in Japan.

Longtime-adopted subjective designation has made the owner's power absolute for GCs. GCs have not been able to even decline the bidding opportunity because if GCs decline the opportunity despite the owner's designation, they may be eliminated from the designation list of succeeding biddings. GCs have been accepting almost any additional orders from the government, which are often not specified in the contract, because of the fear of the absolute power. In turn, the government has usually agreed to pay for changes that are not necessarily caused from unforeseeable events but otherwise would seriously damage the GC, with strategically devised reasons. This Japanese-like collaborative relationship has long prevented GCs from being exposed to associated risks and managing them as well as from performing and structuring efficiently and effectively.[11]

Value Engineering

Three kinds of ***value engineering (VE)*** procurement methods have been tried in Japan since 1997 – VE in design, VE in bidding, and VE after contract, with which the private sector may propose alternative designs or construction means. However, VE has not been common for several reasons. In the Japanese contract system, VE tends to benefit only the owners; the public sector owners dislike changes because the owners need to explain the consequences to the audit, which they fear; VE wastes time of the individuals in the public sector, who are not really rewarded personally in the Japanese

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[10] Watanabe, Ozawa, and Kunishima (1996). "Structural Analysis on Implementation Process of Japanese Public Works from the Viewpoints of Cost, Quality, and Technology Development," Proceedings of 14th Conference on Construction Management Issues, Japan Society of Civil Engineers

[11] Most GCs, however, have been struggling with streamlining themselves in recent years and some have achieved more efficient performance than ever.

seniority system; and both GCs and site managers of GCs have been evaluated by the revenues they obtain rather than the profits, while VE basically reduces construction costs, or revenues for GCs. Nevertheless, some trial cases show advantages for cost reduction or the improvement of ***value for money (VFM)***, particularly in VE in design with up to 26% cost reduction. Also, VE in bidding with design-build proposals has the potential to improve the value for money of the project, provided that the bidding GCs have large enough incentive to intentionally examine various alternatives and ideas with substantial costs to do so.[12]

2.1.3. Government's Role

There is a so-called iron triangle in the Japanese construction industry: Among politicians, governments, and GCs including small firms, politicians control governments with their personnel power, governments control GCs with their contract power, and GCs/small firms have power over politicians with their potentials to collect votes (See **Figure 2-1**).

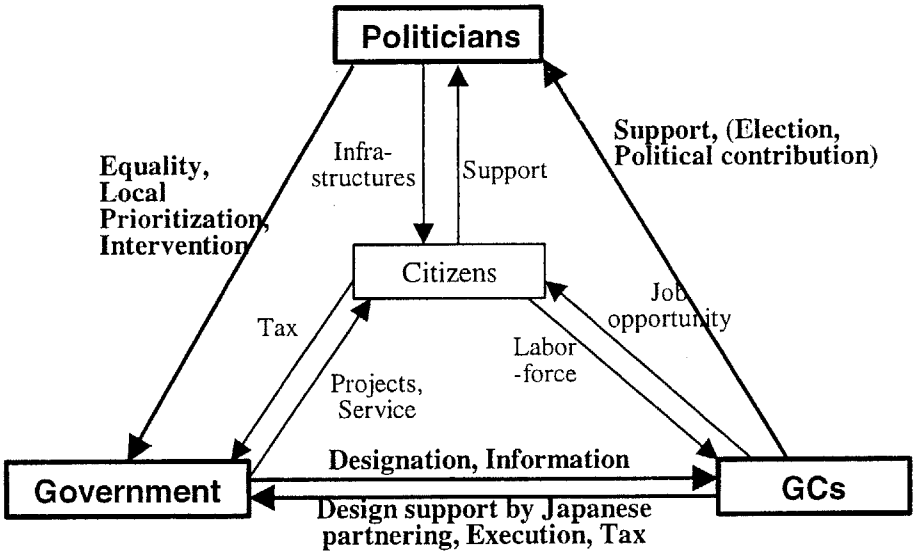

Figure 2-1 "Iron Triangle" with Citizens (Source: Kanemoto ed. (1999))

Ministry of Land, Infrastructure and Transport (MLIT), as representative of the national government for the construction industry, may seek for the industry's efficiency

[12] Nikkei BP. "Special Feature – Requirements that Make Value Engineering Come up to Surface," *Nikkei Construction*, August 11, 2000

by restructuring the industry, such as reducing the number of construction-relating firms and introducing alternative delivery methods. Only MLIT has the power to actually alter the industry system. However, whenever it tries to change something of the delivery systems, politicians intervenes to prevent it to protect construction firms' survival, especially for small firms in their election district, from losing their jobs (not from losing opportunities). So, the number of construction-relating firms has kept growing, and the inefficiency of the industry has remained at the same level, even though large scale companies has restructured themselves internally over the past few years.

The budgeting system is a repeatedly raised issue in the industry. Principles of the *fiscal-yearly order* and of the *complete consumption of annual budget* should be discussed in the context of the industry's inefficiency. The fiscal-yearly order forces the national and local governments to divide a project into smaller phases so that each construction contract of the phase can be accomplished within a budget of the fiscal year. The complete consumption of annual budget represents the system in which the bureaucrats tend to use up the budget in order to secure the next year's budget of their field. The two restraints deprive both the public and private sectors of the incentive to accelerate the construction work and to achieve the cost reduction.

MLIT, however, has recently introduced plenty of policies, such as the Public Works Contract Act, Act for the Facilitation of the Fair Transaction of Public Works, the Technology Utilization System for Public Works, and the Policies to Facilitate the Restructuring of the Construction Industry, to cope with the changing circumstances of the Japanese economy and the industry's needs. With those policies, MLIT is developing a competitive environment of the industry to facilitate the GCs', especially major GCs', efforts toward restructuring, so that the construction companies themselves accelerate the "reformation of the management and organization" and "intensive alliances."[13] For instance, the policies include prioritizing such companies that have technical capabilities, allowing major GCs to build a joint venture (JV) with one another for non-large-scale projects, giving advantages to merged or allied companies, and rooting out those firms that do not have sufficient skills or managerial capabilities.

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[13] Ministry of Construction (2000): Kensetsu Hakusho (Present Status of Land Construction – A Construction White Paper)

2.2. Japanese Construction Companies

This section addresses the profile of the major Japanese construction firms, their roles in the Japanese construction industry, and problems they face and strategies for the future. These descriptions and arguments are important when influences of the implementation of the Japanese PFI and major Japanese construction firms' business strategies are discussed.

2.2.1. Major Construction Firms (MCFs)

Among more than 600,000 construction firms, only some 50 firms are considered large-scale with annual sales of more than ¥100 billion[14], and only five firms are called the "Super-major Five" in Japan, which contain *Kajima, Taisei, Obayashi, Shimizu, and Takenaka Corporations* (in order of the FY1999 revenue in civil engineering). Although the Super-major Five comprise only 8% of the total national construction market (only 4% of the total civil engineering market), the first four firms of the five are referred as ***major construction firms (MCFs)*** in many occasions in this thesis since they have been playing significant roles in the industry and representing the industry well (Takenaka is not included because it engages little in civil engineering projects or public works). However, other large-scale GCs, such as Kumagai Gumi and foreign major GCs, are also sometimes referred as "MCFs" as long as features described in following subsections are applicable. Also, some features discussed throughout this thesis are not limited to MCFs but applicable to other large-scale GCs even if "MCFs" is the subject.

Table 2-1 shows the financial data of the four Japanese MCFs. All of the four companies have been aggressively streamlining their organizations and improving the financial robustness for these five years. For example, Kajima decreased the number of employees by 963 (8%) during FY1999 alone, and the others also have decreased the number of employees by approximately 20 to 30% for the five-year period. Shimizu has reduced the burden of interest-bearing liabilities by ¥200 billion during FY1999 alone, and Taisei has reduced interest-bearing liabilities by 38% for the five years and is planning to further reduce them by another 30% in the next three years.

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[14] For the purpose of convenience, ¥100 = US$ 0.792, or US$1 = ¥126, as of March 31, 2001

Table 2-1 Financial Data of the Four Japanese MCFs in FY1999[15]
(Source: "Business Report," Nikkei Construction, June 23, 2000)

in millions of yen*[1]

	Kajima	Taisei	Obayashi	Shimizu
Revenues				
Civil Engineering	355,934	303,720	301,851	232,496
Buildings	741,674	862,421	738,569	991,410
Total*[2]	1,174,910	1,244,697	1,074,666	1,262,945
Gross Profit Margin				
Civil Engineering	13.7%	11.0%	13.5%	9.9%
Buildings	8.1%	10.6%	8.8%	9.3%
Total in Construction	9.9%	10.5%	10.2%	9.4%
Selling, General and Administrative Expenses (SGA/Revenues)	77,921 (6.6%)	96,404 (7.7%)	84,495 (7.9%)	80,769 (6.4%)
Operating Income	39,361	35,691	24,884	36,046
Net Income (Loss)*[3]	7,632	(78,195)	4,941	8,110
Equity/Total Asset Ratio	10.7%	13.6%	18.3%	11.9%
Interest-bearing Liabilities	568,807	559,477	367,093	593,606
Consolidated Interest-bearing Liabilities*[4]	771,900 →720,000	966,300 → 840,000	589,000 → 530,000	797,400 → 590,000
Liabilities on Guarantee	210,884	55,162	205,138	5,155
Net Interest Payment	4,590	6,140	(130)	4,030
Number of Employees (Decrease from Last Year)	11,664 (963)	11,525 (574)	11,410 (323)	10,822 (−)*[5]

*[1] US$1 = ¥126 as of March 31, 2001 (US$1 = ¥106 as of March 31, 2000).
*[2] Total revenue includes revenue from real estate and other operations.
*[3] For the net income, not only interest and taxes but also the write-down of real estate and other, the valuation loss on investments in subsidiaries and affiliates, the provision for doubtful accounts, and the provision for severance payments are subtracted from the operating income to a significant amount. This reflects the changes of the accounting system toward the international accounting system; however, the accounting policies are still different among companies. For example, Taisei appropriated ¥28,073 million for the write-down of real estate and other and ¥36,638 million for the provision for severance payments, while Kajima set such adjustments in the previous years.
*[4] Figures are cited from several newspapers and shown as of March 31, 2000 actual → March 31, 2001 forecast.
*[5] less than 323

[15] Figures in the table are from the non-consolidated financial statements of each company. Kajima, Obayashi, and Shimizu are generally assumed financially robust because the Interest-bearing Liabilities/ Revenues ratios of consolidated data are roughly below 40%, while that of Taisei is about 48%.

2.2.2. Major Construction Firms' Roles

MCFs are playing crucial roles in the Japanese construction industry. Each of them has more than 10,000 employees, around ¥10 billion R&D budget per annum, and some 100 engineers in-house design divisions, even after the recent significant reduction of those numbers. They are involved in all major domestic construction projects as main contractors. Only MCFs have both knowledge and experiences of all of design, construction, and R&D, and this makes MCFs possible to develop technically difficult projects with capability to take completion risks in such projects.

MCFs have helped governments and consultants almost for free, yet with adding part of the fee to their bidding price, where Adjustment works, as mentioned in the foregoing section. In return, governments protect MCFs from exposing into real competitions and risks. Some call this feature "Japanese partnering and VE" (Kanemoto ed., 1999).[16]

2.2.3. Problems and Strategies of the GCs

Financial status of construction companies and corporate strategies

The financial status of some construction companies looks problematic with huge long-term/short-term debt, while that of others seems quite robust. Many GCs invested a lot of money in land and buildings in the "bubble" era, expecting that those land and buildings would be developed and thereby produce much more value than the investments. Sometimes they intended to develop the land and buildings for themselves to get profits from the generated construction work. However, once the "bubble" collapsed, those investments turned to doubtful accounts, which might not be returned. Japanese construction companies are now trying to restructure their organization and financial structure by reducing the number of the employees, by operating more efficiently, by shedding unprofitable subsidiaries, and by carefully assessing risks involved in development projects.

Stock prices of construction companies dropped significantly after the "bubble collapse." The so-called financial "big bang" caused commercial banks to more strictly

[16] Yet, it is not necessarily true in the current industry circumstance.

select the companies in which they would continue to invest (more accurately, with which they would continue to cooperate). Construction companies were the first and main targets for them to stop investing because of their poor financial status and the low growth expectations of the industry. As a result, several medium-sized firms went into bankruptcy, causing further disinvestments in construction firms. Whether the stock price of a construction firm has decreased a lot or only nominally is more dependent on how much the company has invested in the bubble of land and buildings than on how profitably it is operating its core construction business.

GC's international construction strategy

Since GCs are not efficient enough because they are not used to real competitions, they mostly have lost "real" international competitive biddings. Although Japanese GCs have undertaken a huge amount of construction work abroad, most of them have been projects with Japanese government grant or invested facilities of Japan-based companies. Also, they are still so conservative that they cannot help adding too much premium on their bids because they have experienced losses in the past, although, of course, this varies with the companies. Some have had successful experiences in overseas ***build-operate-transfer (BOT)*** projects, which are to be also investigated in this thesis.

Why no M&A happens in the Industry

No major M&A (merger and acquisition) has happened in the Japanese construction industry. M&A requires absolute efficiency of the business, which is the weakness of the Japanese construction industry. In this industry, even if two major companies merge or align, because indirect costs are mostly generated in each construction site, those costs increase proportionally. Consequently, improvement of efficiency cannot be expected as much as in other industries such as financial institutions and manufacturers.

Another more characteristic reason exists for this regard. In the Japanese bidding system, government agencies have designated some 5 to 10 preferred GCs depending upon the project size, followed by those contractors' bidding. The designating procedure is not apparent, but basically it aims to equalize opportunities within the same rank groups defined by the scale, such as revenues and the number of employees. Hence, if

two GCs in the same top category merge, the new GC would have half of the number of the opportunities the two companies would otherwise obtain.[17]

[17] To facilitate the restructuring of the industry, or M&As among GCs, MLIT will introduce a policy by which those GCs with weak financial status need to meet additional restrictions to bid large-scale national projects in the near future.

2.3. Delivery Systems and Project Finance Abroad

As the background of the development of this thesis, delivery systems and, in particular, project finance outside Japan should be observed. While developing countries have been eager to adopt privately financed project delivery system like the BOT scheme, this section looks at those in the United States and the United Kingdom because of the similarity of the risk profiles of projects with those in Japan.

2.3.1. Privately Financed Projects

Plenty of examples that are financed privately and packaged design-build-operate altogether, that is, ***DBFO (design-build-finance-operate)*** or BOT experiences, exist outside Japan. Some of those have been well organized and have succeeded; others have not. Toll road/bridge/tunnel projects are the special interest of this thesis, and so are PPP projects in general.[18] Both in rapidly developing countries, such as Southeast Asian countries, and in developed countries, such as in North American and European countries, there are a substantial number of PPP projects including quite different kinds of risks, from which various data are collected. It is important to analyze some of these projects and to examine how public infrastructure delivery systems, among which this thesis includes the American and the British ones, have been changed and expanded, just advancing Japanese construction circumstance.

After the outlook of the trends in delivery systems in the U.S. and in the U.K., Chapter 4 describes case studies, which shed light on project scheme, project financing, risk evaluation and allocation, and roles and the strategic position of construction companies in project consortia. Cases include Canadian and Australian privately financed projects as well as those in the U.S., in the U.K., and in Japan. For example, in the Confederation Bridge project, which was delivered under DBFO method, the Canadian government partially subsidized the project as payment equivalent to the ferry service expenses, which was terminated upon the bridge's operation. A variety of risks are well mitigated between the consortium and the government through various agreements, insurances, bond terms, and all other contracts. The construction companies

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[18] PPP (public-private partnership) is briefly explained in footnote 4.

in the consortium dramatically reduced its construction cost by their design-build cooperation and R&D efforts, which had brought about the success.

2.3.2. Trends in Delivery Systems in the U.S.

America's infrastructure holdings are currently worth about 10 trillion dollars, of which two-thirds are held by the private sector, and 85 % of the remaining one-third are held by the state or local public.[19] Construction market in 2000 in the U.S. was $819 billion (cf. ¥67.1 trillion in Japan in FY1999, or $633 billion at the rate of ¥106/US$1).[20] The trend of the market in the U.S. has been relatively steady and the market has expanded for nine consecutive years. Residential construction is the largest market (46%), and transportation work has increased due to a new federal legislation (Transportation Equity Act for the 21st Century) that increases funding for transportation work by 44% over the six years.[21]

The American public infrastructure delivery system has been changing over the long (for two hundred years) and short (for a decade) time span. The traditional delivery system in the U.S. is the Design-Bid-Build (DBB) method, just as in Japan.[22] It has been working well and differently from Japan's in that contracts are very elaborate and arbitration systems are well established, and that engineers (equivalent to Japan's consultants) have a firm respected status as an independent profession. However, as conflicts and lawsuits among the owner, the engineer, and the contractor become more common, and as the owner's incentives become more diverse, new delivery methods have come to be considered. Now construction management (CM), design-build (DB) contracts, and BOT schemes are much more common than ever throughout the country. Since those innovative delivery methods are still quite new for many owners, there remain lively arguments about delivery systems in both academia and industry.

Miller found ten fundamental elements that must be incorporated into infrastructure development to properly balance the respective interests of governments,

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[19] Miller, John B. (1999): Construction Project Delivery Systems, Public/Private Infrastructure, MIT
[20] ENR (2000): "A Look at a $3.4-Trillion Market," *ENR*, Vol. 245 No. 22
[21] ENR (1998): "A $3.2-Trillion World Market," *ENR*, Vol. 241, No. 21
[22] The Japanese construction circumstance has lately been following the same trends with more rapid pace.

taxpayers, users, and industry through his research and many case studies of significant recent projects in North America where Design-Build-Operate and Design-Build-Finance-Operate were used. The ten fundamental elements, which are also suggestive to Japanese new infrastructure delivery system, are as follows (Miller, 1999):

- Government-Defined Scope
- Head-to-Head Competition
- Fair Treatment of Actual Competitors
- Transparency (or Fair Treatment of Potential Competitors)
- Safety Confirmed (or an Independent Engineering Peer Review)
- Open to Technological Change: strategies that permit and encourage new technologies
- Financial Analysis over the Project Life Cycle
- Restoration of a Dual Track Strategy: simultaneous use of direct and indirect financing strategies
- A Scenario Approach to Capital Programming, and
- Pace: a new focus upon the level of investment of governments

2.3.3. The Private Finance Initiative (PFI) in the U.K.

Before the introduction of the PFI in the U.K., the delivery system in the U.K. had been also the DBB type, namely, the public agency designates an architect/engineer, then selects a contractor by a competitive bid, and after the completion, operates under the responsibility of the public agency. The public facility was financed by the public funds.

The preliminary approach toward the PFI was begun (not so named yet) in the United Kingdom by the Thatcher government, which adopted "small government" as its slogan. The Major government, which succeeded the Thatcher government in 1990, introduced the way of thinking of the Value for Money and first proposed the PFI in 1992. The Blair government of the Labour Party has been trying to improve the PFI scheme. For example, the Treasury Taskforce was established as one of the recommendations of Bates review in 1997 and has roles such as providing guidelines for the PFI and arrangements of projects. PFI projects now accounts for 20% of total public works in the

U.K. Main driving forces of the PFI for the British government are 1) value for money (VFM), 2) infrastructure needs, 3) risk mitigation, 4) debt saving, 5) reduction of responsibilities of the government, 6) philosophical reasons, and 7) the innovation expectation. Among the seven, 1) VFM and 5) & 6) Philosophy of "the small Government" were crucial in the U.K.[23]

The British PFI contains the following three types: [24]

1) *Services sold to the public sector* type, in which the private sector finances, designs, builds, operates, and provides services to the public sector such as hospitals, prisons, and roads, for which the public sector pay to the private sector. To date this type of PFI activity has been the primary focus.
2) *Financially free standing projects* type, where the private sector supplier designs, builds, finances and then operates an asset, recovering costs entirely through direct charges on the private users of the asset (e.g. tolling) rather than from payments by the public sector. Public sector involvement is limited to enabling the project to go ahead through assistance with planning, licensing and other statutory procedures. There is no government contribution or acceptance of risk beyond this point and any government customer for the specific service is charged at the full commercial rate, and
3) *Joint ventures* type, where the costs of the project are not met entirely through charges on the end users but are subsidized from public funds. In many cases, the public sector subsidy secures wider social benefits not reflected in project cash flows (e.g. reduced congestion, economic regeneration). However, there could also be service benefits (e.g. from a shared facility) or direct financial rewards. The subsidy can take a number of forms, but the government role is limited to a contribution to asset development. Operational control rests with the private sector.

The basic concept of the PFI is that the public sector sets the level of services and the private sector provides the services and operates the necessary facilities. Different from mere privatization, the public sector retains an important role in the PFI.

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[23] Japan Project-Industry Council (1998): Eikoku oyobi Osutoraria no PFI jigyo ni okeru Seifu to Minkan Jigyosha tono Kankei ni tsuite (Public-Private Relationship in British and Australian PFI Projects), JAPIC
[24] The Treasury Taskforce, U.K. (1997): Partnerships for Prosperity

2.4. Other Relevant Issues

This thesis describes some important issues as the background in different sections as shown below in order to closely position the relevant background with the topic of each section.

Public-Private Partnership Environment	Section 3.1
The Japanese PFI	Section 3.2
Risk Types (in Toll Road Projects)	Section 4.1.2
Japan's Construction Industry	Sections 2.1, 2.2, 5.1.1
Japan's Economy	Section 5.1.2
Toll Road System in Japan	Section 5.2
Utility Function Theory	Section 6.1.3
Portfolio Management Theory	Section 6.1.4

Chapter 3. Introduction of the Japanese PFI

This chapter describes the PFI (Private Finance Initiative) in Japan and its characteristics in general. The Japanese PFI was recently introduced to contribute to the efficient and effective development of infrastructure and thereby to the robust development of Japan's economy by means of encouragement to utilize the private sector's financial, managerial, and technical capabilities for the construction, maintenance, and operation of public facilities, including planning for them (The PFI Act, 1999). However, the national government represented by the MLIT (Ministry of Land, Infrastructure and Transport) does not seem to be highly motivated, and in fact, there has been no PFI project, except one, initiated by the national government despite the fact that some local governments are eager to introduce the PFI scheme into their public facilities procurement system. Also, there are several concerns and arguments anticipated or found from some pioneer cases, such as governmental participation including financial supports, time consuming preparation for the agreements, various regulatory restrictions, and so on. This chapter is limited to the description of basic facts and characteristics of the Japanese PFI, while further analyses, such as comparisons with many other delivery systems both in Japan and abroad, risk arrangements, and financial structuring with the perspective of the current Japanese construction industry, are discussed in Chapter 5.

3.1. Public-Private Partnership Environment in Japan

Before entering into the Japanese PFI, it is useful to understand the environment in which the PFI was introduced. Brief descriptions of public-private partnership and project financing in Japan follow.

3.1.1. Public-Private Partnership in Japan

PPP (public-private partnership), in a broad sense, has been well established in Japanese culture. The public sector always controls and protects the private sector, and the private sector always obeys the public sector through loosely worded contracts.

When PPP projects are defined as those projects that both the public and private sectors are involved in planning and financing, the only type of delivery system is the experiences of the ***third sector projects***, where both public and private sectors capitalize the "third sector" and cooperate together to plan, design, build, finance, and operate the projects. The third sector projects in Japan are regarded as having failed in general, and actually many of them went bankrupt for the following reasons: Contracts between the two sectors were incomplete and neither sector identified cases of downside scenarios; participants expected the government to be responsible for any financial deficit with no written contract, and it actually was; and no one cared about potential risks, especially market risks, and risk allocation. Accordingly, no party had incentives to keep within its original budget and to establish a business plan for those projects.

Given this PPP situation, the Japanese PFI has been recently launched in order to, among other aims, utilize the private sector's financial resources, managerial skills, and technical capabilities. PFI originates in the U.K., as mentioned in Chapter 2, and has been applied to public infrastructures such as roads, bridges, hospitals, government offices, jails, and also even systems design.

3.1.2. Project Finance in Japan

Characteristics of Project Finance

Definition of "***project finance***" is the finance for a specific project, whose sources of repayment of capital and interest are limited to cash flows generated in the project, and whose collaterals are limited to the assets of the project.[1] The non-recourse or limited-recourse financing is one of the most significant characteristics of project finance with which financing institutions are on the same boat, or the "project," with the project company. In other words, the project company and, in general, the financiers cannot

[1] Ohara, Katsuma (1997): Purojekuto Fainansu (Project Finance), Kin-zai

require the parent companies to repay the debt. From the perspective of the parent company, the project financing prevents the company from being exposed to the financial risks that affect its balance sheet (i.e., off-balance), except for the initial equity contribution to the project. The collateral of the project financing is, in practice, the summation of cash flows of the project, that is, project financing is cash flow lending.

Project finance is also a structured finance, with which every participant proactively structures the project through a variety of contracts, which properly allocate surrounding risks. Throughout the negotiation process of risk sharing and conditioning of a project, project financing is structured as a consequence of diverse and dynamic process for sponsors and lenders, together with respective advisors, with tremendous amendments of both project and financial structures. One of such structure requirements is that a ***project company ("undertaker")***[2] should be a ***single purpose company (SPC)*** so that the financed project does not include additional uncertainties of multiple projects.

Financial Institution's Perspective

Lender's incentives for project financing are the following four: a requisite function for international wholesale banks, clarification of risks (a borrower must be an SPC and must report cash flows more strictly), high profitability, and a competitive advantage in the marketplace. Terms and conditions of project financing schemes are set partly as follows.

Finance Conditions: Interest rates are expressed as LIBOR (London Inter Bank Offered Rate) plus spread or a rate of a specific national bond plus spread. The lender sets a yield by adding upfront fees and agent fees to the interest spread in order to make the finance more profitable and to invite other financial institutions attractively for the syndicate. Pricing, or the yield, is dependent on the lender's expected return-on-equity (ROE) and policy on risk management. Pricing experiences for past deals (same kind, same scale projects) are the base indexes.

Legal Aspects and Agreements: A project company has some restrictions, such as those about additional borrowing from other financial institutions but the lenders,

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[2] Terms, "project company" and "undertaker," are both used in this thesis for a private entity that is responsible for the overall practical implementation of a public facility. "Undertaker" is especially used for the term of the provision of the PFI Act, while "project company" is used in more general occasions.

additional investment, production schedule, and a variety of covenants ("must do" and "mustn't do"). The lender retains the right to control assets of the project in case of default, which include not only fixed assets such as production plants but account receivables, cash flows, the concession agreement in BOT projects, rights to use its infrastructure, and so on. The lender may have senior position against a third party as collateral, and control of sales agreement.

Project Financing in Japan

PPP projects are financed by several kinds of financial schemes in Japan. However, none of the scheme is project financing except for few recent experiences, but every financial scheme for the PPP project uses some sort of government budgets from taxes or other resources. The so-called third sector project, e.g., the Trans Tokyo Bay Highway, is one of the types of PPP financial schemes, but few projects of this type were successful as mentioned a little earlier.

While Japanese financial institutions have experiences in project financing, few major construction companies have ever been involved in project finance opportunities. And both the financial institutions' and the few construction companies' experiences were outside Japan. It is necessary to understand and address why project financing has not been familiar in Japan and among Japanese construction firms, what lessons we have learned from a number of failures in the third sector delivery method, and what real trends of project financing exist in Japan. It might be helpful to take into consideration financing for other projects than public infrastructure construction projects. Such projects as establishments of factories/plants for automobile/chemical companies require additional financing for their construction, where corporate finance rather than project finance is always used in Japan. This might be related to the Japanese business tradition, e.g., the inter-dependence of shareholding between the project company and its main banks to keep a good relationship between the two. It is also necessary to recognize that the public sector and many major private companies such as railroad companies and electricity companies do project finance in some sense.

3.2. The Japanese Private Finance Initiative

The PFI Act was promulgated in July 1999 and enforced in September 1999. The main objective of this law was originally to promote new business in order to recover from serious economic recession. The PFI in Japan is a new delivery method, by which public facilities are built, maintained, and operated with the private sector's financial, managerial, and technical capabilities. If a public service is provided more efficiently and more effectively by utilizing the private finance, management, and technical capabilities than by the public agency, then the PFI method will be adopted. With the PFI, higher VFM is expected. ***The Basic Policies*** were determined and published by the Prime Minister on March 13, 2000 as a framework to implement any individual PFI project. "***Guidelines***," detailed implementation policies based on the Basic Policies, must be established in compliance with the Act. "The Guideline for the Implementation Process of the PFI Project" and "The Guideline for Risk Allocation of the PFI Project" were published on January 22, 2001, although "The Guideline for the Evaluation of the VFM (Value for Money) of the PFI Project," the last Guideline, has not yet published as of April 30, 2001.

3.2.1. The PFI Act

The following is the outline of the PFI Act.[3] Numbers represent the actual article number of the Act. More concrete, detail framework of the contents described in the Act is included in the "Basic Policies" section. Distinctive features of the Act, compared to current delivery systems in Japan, include the establishment of an independent committee, the publication of the process throughout the selection of the project, the obligation of the resolution of diets, risk allocations written in the contract, and the direct agreement concept.

1. *Objective*: This Act aims to contribute to the efficient and effective development of infrastructure and thereby to the robust development of Japan's economy by means of encouragement to utilize the private sector's financial, managerial, and technical

[3] Japan (1999): "Minkan Shikin tou no Katsuyo ni yoru Kokyo Shisetsu tou no Seibi tou no Sokushin ni kansuru Horitsu (PFI Act)," *Law 1999* No.117
Terms in English are not official. The government does not provide official translations into English.

capabilities for the construction, maintenance, and operation of public facilities, including planning for them.

2. *Definition*: ***Public facilities*** include the following: 1) infrastructures such as roads, railways, ports, airports, rivers, parks, waterworks, sewerage, industrial water, and so on; 2) official facilities such as government office buildings, quarters, and so on; 3) facilities for the public welfare such as public housing and educational or cultural facilities, waste treatment plants, medical facilities, social welfare facilities, rehabilitation facilities and asylums, public parking garages, underground shopping arcades, and so on; and 4) telecommunication facilities, heat supply facilities, new energy facilities, recycling facilities, tourist attractions, and research facilities.

The specific project is the development of public facilities (construction, maintenance, operation, or planning for them, including services supplies) that can be done efficiently and effectively by utilizing the private sector's financial, managerial, and technical capabilities.

The managing agency is: 1) the minister who is the manager of the public facility or the specified project, 2) the governor or mayor who is the manager of the public facility or the specified project, or 3) the special corporation or the public corporation that develops the public facility.

The PFI project is the specific project selected in compliance with Article 6

The undertaker is the entity that is selected as the undertaker of the PFI project in compliance with Article 7.

3. *Basic Philosophy*: Public facilities development projects should be commended to the private sector entities as much as possible if the public facility is suitable to the private sector because, for example, the cash flows of the project suffice for the cost, taking into consideration the appropriate role sharing between the government and the private sector and efficient use of financial resources.

For the specific projects, the national or local government and the private undertaker shall clarify the responsibility allocation, and reasonable price and excellent services shall be provided to the citizens with the private sector undertaker's full exercise of its technique, managerial resources, and ideas by minimizing the government's participation.

4. *Basic Policies*: The prime minister shall prescribe the Basic Policies for the implementation of the specific projects in compliance with the Basic Philosophy. The Basic Policies shall provide basic matters regarding the following topics: 1) the selection of the specific projects, 2) the invitation and the selection of the private sector undertaker, 3) fair and certain implementation of the project, including the clarification of the responsibilities of the private sector undertaker, and 4) the legal and taxation support and the financial and monetary assistance provided to the undertaker.

5. *Implementation Policies*: The managing agency shall stipulate the Implementation Policies in compliance with the Basic Policies in selecting a PFI project in Article 6 or a private sector undertaker in Article 7.

   Implementation Policies concretely stipulate: 1) the selection of the specific projects, 2) the invitation and the selection of the private sector undertaker, 3) fair and certain implementation of the project, including the clarification of the responsibilities of the private sector undertaker, 4) location, scale, and distribution of public facilities, 5) the resolution policy in the case of uncertainties about the business plan or agreements, 6) the resolution policy in the case of difficulties to continue the project, and 7) the legal and taxation support and the financial and monetary assistance

6. *The Selection of the PFI Project*: The managing agency may select the PFI project in compliance with the Basic Policies and the Implementation Policies.

7. *The Selection of the Private Undertaker*: The managing agency selects the private undertaker.

8. *Objective Evaluation*: The managing agency shall make an objective evaluation in selecting the specific project and the undertaker, and announce the results.

9. *Local Council's Vote*: Local governments shall pass the local council's vote to contract a specific project that meets the criteria stipulated in the government ordinance.

10. *Implementation of the PFI Project*: PFI project shall be proceeded in compliance with the business plan or the agreements prepared by the managing agency and the undertaker based on the Basic Policies and the Implementation Policies.

    When the undertaker is partially sponsored by a public agency, the business plan or the agreement shall clarify the allocation of the responsibilities between the managing agency and the undertaker.

11. *Debt Payment of the National Government*: If the national government pays for debt of a PFI project, the payment shall continue for no more than 30 years.

12. *Use of Public Land for Free of Charge*: The national and local governments may lend public land for the use of the PFI project for free or at a lower price than the market price.

13. *Non-Interest Lending*: The national government may lend money without charging interest from the budget. It may utilize a governmental financial institution, such as the Development Bank of Japan.

14. *Reservation of Funds and Consideration of Local Bonds*: The national and local governments strive to reserve or accommodate necessary funds for the PFI projects, or to specially consider local bonds.

15. *Consideration of Acquisition*: Proper consideration with regard to land acquisition for the PFI project is given so that the undertaker can acquire and use the land without difficulties.

16. *Supports*: The national and local governments shall provide the legal and taxation support and the financial and monetary assistance as needed, reflecting the Basic Policies and the Implementation Policies.

17. *Deregulation*: The national and local governments shall encourage the deregulation in order to facilitate the implementation of the PFI projects.

18. *Cooperation*: The national and local governments and the private undertaker shall cooperate one another to facilitate the implementation of the PFI projects.

19. *Enlightenment and Technical Assistance*: The national and local governments promote enlightenment activities for the public and consider the technical assistance for the private sector such as the coordination of the use of patents.

20. *Utilization of Collateral Real Estate*: If the undertaker utilize a collateralized real estate, and if the real estate incurs loss, the pertinent companies may capitalize the loss in the equity part of the balance sheet, which shall be depreciated within ten years.

21. *The PFI Committee*: The PFI Committee investigates and deliberates on PFI projects. The Committee may advise and hear from the governors and the mayors.

22. *Organization of the Committee*: The committee consists of nine members appointed by the prime minister.

23. *Authorization to the Government Ordinance*: The government ordinance stipulates other requirements to give effect to the Act.

3.2.2. The Basic Policies[4]

The Basic Policies stipulate in the preamble that potential effects of the implementation of the PFI and the objectives of the PFI Act are the following three points. First, the PFI is expected to provide less expensive and quality public services. This includes helping both the national and local governments restructure the financial status, utilizing the private sector's managerial skills and technical capabilities for the public facilities, managing risks efficiently, and combining some or all of the design-build-maintain-operate steps and thereby easing the financial obligation of the projects.

Second, the public sector's style of involvement in the implementation of the public services will be reformed. As private undertakers take over the roles of the public agencies, a new public-private partnership formation is expected on the basis of the proper role sharing.

Third, creating business opportunities for the private sector boosts Japan's stagnant economy. The new business opportunities include the PFI projects themselves, the combination with other profitable projects surrounding the PFI projects, and the new financing market, which will be introduced by adopting project finance as the financing method for the PFI projects. As a result, the creation of new businesses and the promotion of economic structural reformation are also expected.

The Basic Policies articulate five fundamental rules and three basic principles of the PFI projects to achieve the basic philosophy and the expected outcome. PFI projects are required to have the following attributes:

1) The public use rule: making projects into public facilities;
2) The private resources utilization rule: utilizing the private sector's financial, managerial, and technological resources;
3) The efficiency rule: making use of the private sector's autonomy and creativity;

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[4] Cabinet Office, Japan (2000): Minkan Shikin tou no Katsuyo ni yoru Kokyo Shisetsu tou no Seibi tou ni kansuru Jigyo no Jisshi ni kansuru Kihon Hoshin (The PFI Basic Policies)

4) The justice rule: ensuring fairness in selecting a project or an undertaker; and
5) The transparency rule: making the whole process visible to the public.

In implementing the projects, they should follow several principles:

1) The objectiveness principle: ensuring objectivity in the evaluations and decisions for the implementation of the PFI;
2) The contract principle: providing explicit contracts to define roles and responsibilities of the participants; and
3) The independence principle: Assuring the undertaker's independence of other business contracts.

The managing agency is expected to try to procure as private projects any public facilities that would contribute to the efficiency of the finance or the improvement of the public services by implementing them privately. **Figure 3-1** shows interactions among the public agency, the private undertaker, and citizens in the Japanese PFI scheme.

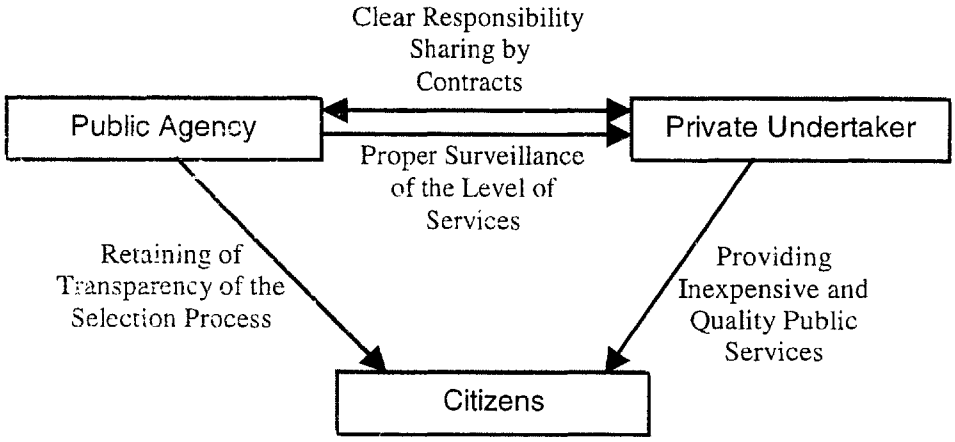

Figure 3-1 Interactions among Public Agency, Private Undertaker, and Citizens in the PFI Scheme

The Basic Policies also prescribe necessary concerns for each step of the process of PFI projects as **Table 3-1**.

Table 3-1 Prescriptions of the Basic Policies for Necessary Considerations

A. Selection of the Specific Project	
Step	**Public Agency's Responsibilities**
(1a. Proposal from a Private Entity)	- Preparation for administration and evaluation of proposals from private entities
1. Proposal of a Project	- Examination of the project to implement as a PFI and adoption of proposals from private entities - Prioritization of the projects that fit better as PFIs and have more potential needs of the citizens
2. Formulation and Announcement of the Implementation Policies	- Early formulation and announcement of the implementation policies with fairness and transparency - Concreteness of the contents and acceptance of general progress of the policies - Clarifying the public agency's participation, potential risks, and likely allocation of the risks - Clarifying necessary approvals, the extent of the maintenance and operation of the public facilities, and adaptable subsidies and financing
3. Evaluation, Selection, and Announcement of the PFI Project	- Minimum standard for the attainment of more efficient and more effective procurement of public services by the PFI - Evaluation of the public expenses with net present value in calculating value for money - Quantitative evaluation principle and qualitative evaluation with objectiveness if the quantification is difficult - Retaining transparency in announcing the selection
B. Invitation and Selection of the Private Undertaker	
Step	**Public Agency's Responsibilities**
4. Evaluation, Selection, and Announcement of the Private Undertaker	- Guarantee of the competitive environment and ensured transparency of the process - Regard for the exertion of the private entity's ingenuity, regard for sufficient time to prepare the proposal - Securing objectivity of evaluation criteria for the "overall judgment," if applied - Consciousness of performance-based order - Fair provision of information to private entity's questions

(Continue)

(Continued)

Step	**Public Agency and PFI Undertaker's Responsibilities**
5. Agreement	- Abiding by the agreement and its disclosure • Concrete and explicit arrangement of each party's rights and obligations • Provisions for the guarantee of adequate public services • Surveillance of the level of public services • Reports of the state of the operation and finance • Independent experts' investigation and report • Nominal participation of the public agency to secure safety and preserve environment • Clarification of the risk allocation with regard to appropriate risk distribution and clarification of the treatment of risk mitigation and hedging • Concrete and explicit provisions about the termination of the contract in case of difficulties • Concrete and explicit provisions in case of problems arising in interpreting the agreement
C. Implementation of the PFI Project	
Step	**Public Agency and PFI Undertaker's Responsibilities**
6. Implementation of the Project, Surveillance	- Implementation of the project in compliance with the agreement - Surveillance of the level of the public services
7. Termination of the Project	- Actual treatment in compliance with the agreement

3.2.3. The PFI Guidelines

"The PFI Guidelines," detailed implementation policies of the PFI projects based on the Basic Policies, must be established in compliance with the Act. The Guidelines contain three parts: one for the implementation process, one for the risk allocation, and one for the evaluation of the VFM. "The Guideline for the Implementation Process of the PFI Project," which outlines the flow of the series of the implementation procedure and addresses matters of concern in the process, and "The Guideline for Risk Allocation of the PFI Project," which states points to beware of in arranging risk allocation for the PFI project, were published on January 22, 2001. "The Guideline for the Evaluation of the

VFM (Value for Money) of the PFI Project," which will explain the evaluation of the VFM conducted in selecting the PFI project, is currently being prepared for the publication as of April 30, 2001.

The PFI Guidelines are the practical guidelines, by which the national agencies are supposed to implement PFI projects, in compliance with the PFI Act and the Basic Policies. The Guidelines can also serve as the references for non-national public agencies. Because PFI projects go into high gear from now, the guidelines may be amended.

The Guideline for the Implementation Process of the PFI Project [5]

As most features of the guideline are described in various sections of this thesis, only characteristic contents of the guideline are introduced here. When either the government or a private entity considers a PFI project, if the project contains purely private, for-profit facilities, the private facilities should be separated from the PFI project. Consultants or advisors for the financial, legal, and technical issues may be retained, but in such cases, it is necessary to secure the credibility for confidentiality and fairness. In inviting offers and evaluating them, public agencies need to consider reducing the burden of the tenderers to prepare for the competition by, for example, limiting the final proposals only to a few pre-qualified consortia. Clearly expressing evaluation criteria is also important.

The Guideline for Risk Allocation of the PFI Project [6]

"The Guideline for Risk Allocation of the PFI Project" describes basic concepts and policies to manage risks that may occur in the course of the PFI project. The risk management should proceed by first recognizing the potentials and the sources of the risks, valuating the influence of the risk, identifying the risk taker for each risk, and allocating the risk. Risks shall be identified and characterized as much as possible, and shall be allocated on the basis of "Who could manage the risk best shall bear it."

The guideline is followed by the description of the types of risks and their examples managed in each stage of the PFI project: investigation and design stage, acquisition stage, construction stage, maintenance and operation stage, and termination

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[5] Cabinet Office, Japan (2001): "PFI Jigyo Jisshi Purosesu ni kansuru Gaidorain (The Guideline for the Implementation Process of the PFI Project)," 6th PFI Committee

[6] Cabinet Office, Japan (2001): "PFI Jigyo ni okeru Risuku Buntan tou ni kansuru Gaidorain (The Guideline for Risk Allocation of the PFI Project)," 6th PFI Committee

stage, together with common risks that may occur in any of those stages. In principle, the guideline suggests that characterizing, allocating, and quantifying risks be arranged on the case-by-case basis because each project has so different aspects in risk profiles that risk allocation arrangements should be structured based on the attributes of each project. Detailed discussions regarding each type of the risk and a variety of ways of risk management, especially surrounding toll road/bridge/tunnel projects, are presented in Chapters 4 and 5.

The Guideline for the Implementation Process Evaluation of the VFM of the PFI Project [7]

"The Guideline for the Evaluation of the VFM (Value for Money) of the PFI Project" consists of following five sections according to a plan of the guideline provided to the PFI Committee:

(a) The basic idea of VFM evaluation: The selection of the PFI project shall be based on whether the project can be achieved efficiently and effectively by the private sector. The VFM of the project is the measurement of the selection decision. That is, if a privately managed project has higher value regarding its cost than the other project the public sector would procure, it has higher VFM and is supposed to be implemented as a PFI project. The evaluation of the VFM is, in essence, the comparison between the ***public sector comparator (PSC)*** and the ***life cycle cost (LCC)*** of the prospective PFI project, each of which is the ***net present value (NPV)*** of the financial cost the public sector would spend for the project, publicly managed or privately managed, respectively. The VFM should be primarily evaluated for the "Services sold to the public sector" project, for which the public sector pays all the cost in compensation for the public services provided. For the "Joint ventures" project and the "Financially free-standing projects," for which the public sector pays part of or none of the cost of the project, the evaluation should be based on the efficiency and the effectiveness of the project as a PFI.[8]

(b) Calculation of the PSC: The PSC is the NPV of the estimated public finance cost of the project that the public sector is assumed to implement. PSC is calculated

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[7] The PFI Committee (2001): Materials for the 13th Subcommittee

[8] For the description of the three types of the PFI projects, see Section 2.3.3.

based on the appropriate cash flow projection for the lifetime of the project, and a prospective formation (e.g., outsourcing) should be assumed. The calculation should include all accrued costs in design, construction, maintenance, and operation stages. Risks in these stages and indirect costs are also quantified and included in the PSC.

(c) Calculation of the LCC of the PFI project: The PFI project is assumed to be a single project combining design, construction, maintenance, and operation of the public facilities. For the use of the comparison with the PSC, collateral facilities should be excluded from the PFI cash flow. The calculation should be made on a clear basis backed by the use of a consultant or by the investigation of the market or the similar experiences.

(d) Instructions for the VFM valuation: When some risks of the project are assigned to the private sector undertaker, these risks should be included in the PSC to compare to the LCC of the PFI project. Risks that should be included in the PSC are identified in accordance with "the Guideline for Risk Allocation of the PFI Project." As a basic concept, risks can be quantified by multiplying the prospective financial cost of the public sector in the occurrence of the risk and the probability of its occurrence.

Equitable adjustment should be considered both in the PSC and in the LCC of the PFI project with respect to financial and monetary assistance (by adding it to the LCC of the PFI project) and taxes (by deducting respective amounts from the PSC and from the LCC of the PFI project). In converting the cash flow to the NPV, a risk free rate, such as the rate of the long-term government bond, is applicable as the discount rate. In summary, the PSC and the LCC of the PFI project are expressed as follows:

$$PSC = NPVBA_{PSC} + RISK - TAX_{PSC}$$

$$LCC = NPVBA_{PFI} + AID - TAX_{PFI}$$

$$VFM = PSC - LCC$$

where, $NPVBA_{PSC}$: The net present value of the public financial cost before adjustments for the publicly managed project

RISK: Costs of the risks that the private sector would assume

TAX_{PSC}: Taxes incurred by outsourcing etc. in the publicly managed project

$NPVBA_{PFI}$: The net present value of the public financial cost before adjustments for the PFI project

AID: Financial and monetary supports by the public agency, such as a government subsidy

TAX_{PFI}: Taxes incurred by the private sector undertaker in the PFI project

(e) The valuation of the level of public services: In selecting the PFI project, calculations of the PSC and the LCC of the project should be based on the same level of services in principle.

3.3. Each Party's Attitude toward the PFI

The PFI is a new scheme of construction project delivery in Japan, and most relevant Japanese parties, including the national and local governments, various consultants, and general contractors, have not experienced the scheme and are shy to be involved. However, they also recognize that the PFI is the current trend and it may grow rapidly after some development period of the PFI's scheme as has happened in the U.K. Though each party, or rather each individual, has different perceptions and different expectations for the PFI, the general stance of each party could be described as follows.

3.3.1. The MLIT's Stance

The MLIT (Ministry of Land, Infrastructure, and Transport) [9] has established the "MLIT PFI Promotion Board," chaired by the Undersecretary, to expand the promotion system in the ministry and has designated PFI consulting staffs in appropriate departments to meet the needs of the private sector. Furthermore, it has studied four prospective types of projects (redevelopment of an urban area, urban park facilities, toll roads, and public housing) to examine the feasibility of the introduction of the PFI. The MLIT has investigated the cases in light of the project scheme, the selection method of the private undertaker, and so on.

However, apparently the MLIT wants to maintain its vested rights to control every public project, so the PFI does not interest the MLIT particularly. For the officials of the MLIT, promoting the PFI and letting the private sector take over the business of planning public facilities mean losing their jobs in part. The establishment of the "Guidelines," which will complement the Basic Policies and make PFI's procedure more concrete, has been deferred. Although the Cabinet Office is in charge of the guidelines and the MLIT has been promoting the PFI officially, as mentioned above, in compliance with the national government's policy, the MLIT has never initiated any PFI project yet.

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[9] To avoid confusion, the MLIT refers to both the Ministry of Land, Infrastructure and Transport (MLIT) and the Ministry of Construction (MOC) in this thesis, though the MOC merged into the MLIT with the Ministry of Transport, the National Land Agency, and the Hokkaido Development Agency on January 6, 2001 and it was the MOC that actually issued "the MLIT's guideline," mentioned shortly.

The officials of the MLIT state that they are looking for target projects suitable as model cases, but they are not successful in finding such projects except "road stations" (service facilities for drivers) and parking garages. Highways are not appropriate to the PFI or the private projects because highways constitute a tolled network system and a single portion of the network is inappropriate as a PFI project. This statement seems to reflect the bureaucrat's prejudice or the view that they could not share the planning business of the large-scale infrastructure systems with the private sector. In actuality, moreover, they require the private sector such as construction firms, which may benefit from the PFI by new business opportunities, to propose target projects, rather than looking for such projects.[10]

Before the PFI Act was enacted as a representatives' legislation, the MLIT made a guideline for the prospective Japanese PFI ("MLIT's guideline"), which is obviously the base of the Basic Policies. The MLIT's guideline emphasizes the effect of the introduction of the Japanese PFI, which would enable more efficient public infrastructure developments by utilizing the private sector's technological capabilities, financial potentials, and managerial skills. It implies the participation of foreign companies, assuming that Japanese firms are competitive enough. The MLIT's guideline also addresses the same three objectives as the Basic Policies, that is, 1) the development of the public infrastructure with the national and local governments' limited resources by promoting the private sector's initiative, 2) the reform of the administrative roles by transferring what the public sector does to the private sector, by benefiting the people with efficiency, and by being accountable to the people, and 3) the creation of business opportunities such as the investment in the public infrastructure and project financing, contributing to the reform of the economic structure in Japan.[11]

Therefore, from the description of the MLIT's guideline and the Basic Policies, the MLIT, at least officially, intended to stimulate the private sector to take part in the public businesses and was supposed to transfer some parts of its obligation to the private sector. Some of the officials are actually aggressive for the movement, by which the Japanese construction industry can become fair, transparent, and efficient, and thereby

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[10] This information is derived, in part, from published materials of the PFI Committee.
[11] Ministry of Construction (1999): "Nihonban PFI no Gaidorain (A Guideline for the Japanese PFI)"

competitive internationally and attractive to the public. While the MLIT had been trying to prevent any middle- to large-scale construction firms from going into bankruptcy because the influence would be larger than that of other industries, given the shrinking (or slimmed) domestic construction market, the MLIT's current policy aims at the circumstance where managerially, financially, and technologically robust firms can appropriately grow in the future slimmed market.

3.3.2. Local Governments' Stance

According to the Nikkei Shimbun's survey of 59 prefectures and major cities, 47 respondents are "considering the possibility of introducing" PFI and 10 "wish to consider it in the future." However, most of them cited difficulties in measuring costs as a major factor that slows down the PFI. Some expressed concerns over the ability of authorities to handle difficult contract provisions such as risk sharing. One authority commented, "We are unsure whether or not the national government will provide such projects with subsidies."[12]

Nevertheless, Kanagawa Prefecture, for example, is aggressively promoting "PFI like" projects while the national government has been struggling to settle the Guidelines. Kanagawa Prefecture has set the evaluation committee, containing fixed professional members, solely for the PFI evaluation. Tokyo Metropolitan Government and several cities, including middle-sized to small cities, have already contracted with respective consortia for their pioneer PFI projects. The capability problem of authorities has been overcome by appropriately adopting financial, legal, and engineering advisory firms. Many experts predict that when some prototype PFI projects turn out to be successful, the PFI will obtain popularity as the public facilities delivery system. In the meantime, however, unless the private sector initiates public facilities projects, most local governments will be very slow to move towards this innovative system.[13]

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[12] Nikkei Shimbun (Neewspaper), July 28, 2000
[13] Nikkei BP (1999): "Special Feature – Work of Civil Engineering 2010," *Nikkei Construction*, October 8, 1999

3.3.3. MCFs' Stance

When the first few projects were announced, MCFs aggressively competed with one another in order to gain the initiative in the future PFI market. They invested initial costs for planning, design, and administrative issues in the projects and learned much about the new scheme.

However, since they have little experience with project finance, risk sharing, and elaborate contract documents, developing a project structure is very time-consuming work and costs them much more than traditional DBB projects. Hence, they are not eager to initiate PFI projects by themselves. Their generic stance seems that if a PFI project appears, they will try it. Also, most MCFs cannot afford to literally invest much in PFI projects because their first priority is to reinforce the financial strength. Some of them seek to just participate in the construction portion of PFI projects as they are doing in the ordinal projects, financially investing up to the project's profit margin.

In around 1999, most Japanese MCFs established the special purpose division for the PFI within the organization, with some (Taisei, Kumagai) making alliance with overseas experienced professional consulting companies. The roles of those special purpose divisions vary depending on the company. For example, Kajima's PFI Management Office is responsible for collecting information of nationwide PFI projects, supporting project teams at the branches, and encouraging and instructing other offices and branches to be aware of the information. In Kajima, project teams at the branches play main roles for prospective PFI projects as they face the local governments, which actually make concepts of the projects and initiate them.

Senior management of MCFs, as well as many economists, expects that PFI projects will substitute for other traditional DBB projects, to some extent, provided the PFI system will have been developed and stabilized. It seems, however, that current discussions on the PFI are focusing on the basic problems, such as who may want to participate in a project, what are the existing alternatives of financing schemes, and what changes will be expected in terms of legal aspects, rather than managerial and financial consideration about risk-return management. Some MCFs are very risk-averse because they had experienced huge financial loss by investing in real estate development projects about a decade ago and a substantial amount of debt still remains on their balance sheet

as noted in Chapter 2. Because of this financial weakness, some MCFs seek for such PFI projects that cost less and are repaid earlier than large scale, long time-span projects.

3.3.4. Consultants' Stance

Generally, consultants have a feeling of crisis for their position in the future marketplace when the general evaluation method, with which MCFs solely propose both design and construction means to the public (or private) owners, is broadly adopted in the delivery system and MCFs supplant them. Some consultants look at the PFI as a new business opportunity and have researched a lot about the British PFI. Many of the consultant firms published instructive guidance books for the PFI as sales resources for the local governments, and some have been successfully involved in the PFI as an independent engineering advisor for the owner (government).

Consultants may play important roles in the PFI scheme not only as the independent advisor for the public sector but also as a service provider for the project company, for the Design-Build contractor, and for the financial syndicate. For instance, consultants may advise on the feasibility of projects as a PFI and the implementation process of the project for the public sector, especially for the local governments. Financial syndicates also need some service providers that evaluate the project risks on technical matters.

3.3.5. Financial institutions' Stance

Major financial institutions such as commercial banks have enough experiences and expertise with respect to project finance, risk management, and elaborate contract documents overseas. They could just apply their knowledge to newly introduced Japanese PFI projects and actually have already played main roles in current PFI projects.

An investigation shows some opinions of financial institutions[14]:

1) A PFI project should be assumed profitable enough such that 10 to 15% ROE will be achieved in 20 years after the commencement.

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[14] KRI International (1999): Q&A Nihonban PFI no Subete (Japanese PFI Everything)

2) Reasonable scale of investment for the PFI project is from billions of yen to tens of billions of yen.
3) The number of the sponsor companies should be limited so that each sponsor is truly responsible for the management.
4) It is recommended to begin with and to accumulate experiences by small-scale projects, which are relatively easy to estimate the risks.

Despite some doubts of the expectation of the PFI's popularity, major banks have begun the business of loans for PFI projects.[15] Although the loans for PFI projects involve substantial risks because they are on a non-recourse basis in principle and the terms are 15 to 30 year long, the banks assume the benefits may cover the risks. The banks are interested in the PFI business because of the prospective large spread for the PFI projects. While the spread for local governments' bond, which the governments may utilize to procure a public facilities, is 10 to 20 basis points, that for a PFI project is estimated more than 100 basis points. Therefore, financial institutions have the expectations of PFI projects to become a trigger of the business growth.

Also, the Osaka Securities Exchange has established the PFI market. Prospective special purpose companies undertaking PFI projects can apply for the listing of its securities.[16] It is expected that other institutional investors become interested in the PFI business as the alternative of their investment tools, as is described in Section 5.4.2.

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[15] Nikkei Shimbun, Aug.16, 2000
[16] Although the OSE has the policy to accept SPCs to develop a public facility, which is not limited to official "PFI" projects, there is no listing as of December 10, 2000.

3.4. Lessons Learned from the Pioneer Japanese PFI Projects

3.4.1. Pioneer Japanese PFI Projects

A number of projects that local governments initiated as the managing agency and that utilized the PFI scheme have been developed over the past couple of years. Although the number of PFI projects is growing and stages of the development vary project-by-project, outlines of many of those projects are shown in **Table 3-2**.

Table 3-2 Summary of the Pioneer PFI Projects in Japan

(a) Projects with Implementation Policies already Issued (including non-official PFI):

Name (Managing Agency)	Outline
Kanamachi Co-generation Plant (Tokyo Metropolitan Government)	BOO of the co-generation system, Provide Tokyo with electricity and steam, Tokyo pays for them for 20 year term, ¥25 billion, Detail in Chapter 4
Kanagawa Prefectural University of Health and Welfare (Kanagawa Prefecture)	BTO of the university with 40,000 ㎡ floor area, Pref. pays by installments for it for 30 year term, ¥18 billion, Detail in Chapter 4
Kimizu Wastes Treatment Plant (Cities of Kisarazu, Kimizu, Futtsu, Sodegaura)	BOO of the wastes interim treatment plant with capacity of 500t/day, 20 year term, ¥31 billion, Divided into two phases
Hitachi-naka Port, Kita Pier Public Container Terminal Facilities (Ibaraki Prefecture)	Financially free-standing type project, 30,000 (initial)-250,000 (final) TEU/yr, Shipping agents pay for the facilities and services, 20 year term
Chiba Consumers and Measure Inspection Center (Chiba City)	BOT, 2,500 ㎡ floor area plus privately used facilities, City pays for the construction and operation, 30 year term
Fukuoka Retained Heat Utilization Facility (Fukuoka City)	Joint venture type BOT, City provides with electricity utilizing retained heat from a wastes incineration plant, 3,000 ㎡ floor area, 15 year term,
Kanagawa Sanitary Research Institute (Kanagawa Prefecture)	Build and maintenance of the renewal project, Prefecture pays for it for 30 year term, ¥8 billion
Hibiki Container Terminal (Kitakyushu City)	Financially free-standing type project, 700m -15m berth and 340m -10m berth, Shipping agents pay for the facilities and services, 25 year term
Kanagawa Modern Art Museum (Kanagawa Prefecture)	BOT, 6,000,㎡ floor area, ¥5.5 billion
Maya Lodge Development (Kobe City)	BOT, 20 year term, 2,323,㎡ floor area, ¥500 million
Odate Area Wastes Treatment Facilities (Odate City and surrounding Cities and Towns)	BOO, 15 year term, 100t/day treatment
Kinan Communication Center (Mie Prefecture)	Joint venture type, 20 year term, 150ha, ¥17 billion

(Continue)

(Continued)

Asaka-Misono Co-generation Plant (Tokyo Metropolitan Government)	BOO of a co-generation plant (ordinary power, steam, and sodium hypochlorite) with excavated soil utilization, 20 year term
Chowa Elementary School (Chofu City)	The detail is unknown.
Omuta Recycle Power Plant (Omuta City)	The detail is unknown.
Saitama SKIP City Project (Saitama Prefecture)	Next generation visual industry stronghold BOT project for 30 year term, 75,000 ㎡ floor area, ¥28 billion
Hari TRS (Teatime Rest Station) Project (Tsuge Town)	BOT of a "Road Station," 30 year term, ¥5 billion
Fujisawa General Disaster Prevention Center (Fujisawa City)	20 year term, 3,600 ㎡ floor area, ¥6 billion
Matsugahama Redevelopment Building (Izumi-Otsu City)	30 year term, ¥300 million
Fureai Hiroba and Parking (Sabae City)	BOT, 6 year term, ¥50 million
Joetsu City Plaza (Joetsu City)	Joint venture type, 9,472 ㎡, ¥1.1 billion
High Quality Compost Production Plant (Kanagasaki Town)	BOO, 6t/day compost production, 30t/day wastes treatment, 15 year term, ¥480 million

(b) Projects in the Implementation Planning Stage:

Name	**(Managing Agency)**
Shonan Seaside Park Development	(Kanagawa Prefecture)
Esaka Station Multi-floor Parking Garage	(Osaka Prefecture)
Mobile Telecommunication Experimental Facilities	(Ministry of Public Management, Home Affairs, Post and Telecommunications)
Kawamata Town Hall	(Kawamata Town)
Koga Green Park	(Koga City)
New Recycle Center	(Tawara Town)
Nagai Uminote Park	(Yokosuka City)
Recycle Plaza	(Settsu City)
General Cultural Center	(Hirakata City)
Dream Island Plan (Retained Heat Utilization)	(Koto Ward, Tokyo)
Multi-floor Parking Garage	(Suita City)
Techno Green Center (Office and Hotel Complex)	(Saitama Prefecture)
Kure City Hall	(Kure City)
Owada Complex	(Yachiyo City)
Dai-ni Funeral Hall	(Sapporo City)
Fowl Ecology Park	(Osaka City)
Garbage Composting Plant	(Towns of Shiroyama, Tsukui, Sagamiko, and Fujino)
Omihachiman City Hospital	(Omihachiman City)
Public Housing	(Yokkaichi City)
Metropolitan Youth Plaza	(Tokyo Metropolitan Government)
Osaka Prefectural Office Building	(Osaka Prefecture)
Kobe Airport Terminal Building	(Kobe City)
Kihoku Community Center	(Mie Prefecture)

As shown in the table, the overwhelming majority is the building type project such as environmental preservation related plants, community centers, public schools, hospitals, and office buildings, with few exceptions of container terminals. A more notable fact is that it is local governments that initiated all but only one exception (Mobile Telecommunication Experimental Facilities). The national government gives subsidies for some of the projects, in which the government is indirectly participating, but the government should not be approved to participate as an equity holder or to make a single year contract with the private sector so as not to assume the project risk eventually infinitely.

3.4.2. Lessons Learned from the Pioneer Projects

The pioneer PFI projects in Japan shown in the last subsection have given substantial findings in terms of concerns for the full-dress introduction of the PFI, namely, the evaluation of VFM, the allocation of risks, and the process of the PFI implementation. The following are only characteristic examples of the findings for the sake of better understanding of the Japanese PFI, and details of the primary projects are examined in Chapter 4 with explicit matters. [17]

Value for Money

Calculation of the VFM is required in a couple of stages: feasibility study stage of the PFI or the implementation policies setting stage, private undertaker selection stage, and agreement negotiation stage. As the calculation of the VFM is difficult for the public agencies, it has not been a reliable number and should be assumed with some variability.

In comparing the PSC (public sector comparator) to the LCC (life cycle cost) of the PFI, some agencies were confused due to the inconsistency of the specifications of the two proposals, especially when the private tenderers proposed to include their original ideas in the quality. Since private tenderers try to increase the value of the project or sometimes decrease the specification of the facilities within the extent to which necessary

[17] Experiences introduced in this subsection are referred to from the minutes of the PFI Committee.

functions are guaranteed, or to improve the VFM, it tends to become more and more difficult for the managing agency to set appropriate PSC for the comparison. Some managing agencies also claimed that there were various ways to estimate governmental subsidies and taxes from the undertaker, so the equal footing was not achieved properly. Moreover, quantification methods of relevant risks vary. Representatives of the managing agencies commented in the hearings of a PFI Committee that it would be helpful if "The Guideline for the Evaluation of the VFM (Value for Money) of the PFI Project" provided some rates as guidelines. Suggestions from these instances are substantially, but not completely, reflected and included in the PFI Guidelines.

Risk Allocation

Some misunderstand PFI as simply meaning the transfer of risks involved in the project to the private undertaker in exchange for the opportunity of profitability. As a matter of fact, some public managing agencies have transferred force majeure risks to the private undertakers beyond nominal extent despite this, in return, costs more to the public agencies and reduces the VFM of the project.

Since it is very complicated to identify and to quantify the risks involved in a PFI project, together with the fact that no statistical datum of the influence of possible risks is available for public agencies in Japan, one of the most challenging arrangements for a PFI project is financing. Given that financing a PFI project is not satisfactory for the private sector undertaker, sponsors such as construction firms tend to accept excessive equity investment or guarantee, where equitable returns are not necessarily secured and the chance of failure is higher than other projects.

The Process of the PFI Implementation

Almost all of the pioneer PFI projects were in the highly competitive environment because most potential participants strategically placed the projects higher priority to take advantage of early experiences. As a result, many bidding consortia spent extremely expensive cost (up to some ¥200 million) to just prepare for the tender without any compensation. A multi-stage bidding system with pre-qualification, or making short list, and more tangible quantification system of the evaluation are suggested so that unnecessary efforts can be eliminated.

The undertaker selection was problematic in some cases. An instant evaluation committee set an instant criterion for the selection that included subjective measurement without quantification in one of such cases. Even though the evaluation process and the criteria have been released, the result of the selection is still controversial. Pre-authorized and explicitly published evaluation criteria should be essential for the undertaker selection.

3.5. Issues Surrounding the PFI

In addition to the matters raised in the previous section, a number of concerns and arguments surround the Japanese PFI. After the examination of case studies in Chapter 4 and with the analyses of the PFI framework, Chapter 5 presents possible solutions, suggestions, or remaining concerns for most of the following issues.

Implementation and Process Issues

- How can Japan, where long-term credibility is put importance, successfully adapt the PFI borne in the U.K., where the contract documents are of paramount importance and claiming based on the contract is quite common?
- Government supports in legal, taxation, financial, and monetary aspects are addressed and encouraged in the PFI Act, but the movement of the deregulation and the adaptation to the PFI is slow.
- There may be few prospective projects in the large-scale infrastructure area to suit for the PFI, including roads and bridges/tunnels.
- There are several trends that require further examinations because of insufficient experiences: overall evaluation system, design-build-maintenance-operate combined delivery method, and performance specification orders.

- The improvement of the VFM may be also achieved by another innovative delivery method, such as bid with VE proposals, performance specification order, a larger-lot and multi-year contract, or the combination of those, rather than the PFI, which costs more for the administration and interest on debt services.
- Government subsidies are paid annually to local governments for some of prospective PFI projects, so the incentive for the local governments to finish the project early is deprived in order to receive the subsidy every year.
- Why is the technological innovation the outcome of the PFI, in which brand-new technology should be avoided in order not to bear the risk to adopt unproven technology?

Risk Allocation Issues

- If a managing agency proceeds to a PFI project without closely identifying risks and analyzing them, the project would fail and the credibility of the PFI system in the eyes of the people would be lost. Making use of financial institutions is desirable because they would seriously and strictly inspect the assets and debts.
- It is very difficult to quantify the influences of the risks such as demand, time or cost overruns. Time or cost overruns are common in the real world of construction projects and the influences are relatively large. It is necessary to accumulate data of the probabilities and influences of the risks.

Project Evaluation Issues

- Accuracy of the VFM for long lifetime projects is very doubtful.
- Calculation of the PSC is less meaningful if the project is based on the performance specification order.
- It is imperative to quantify qualitative aspects (design, environmental consciousness, level of services, and so on) of projects. Otherwise, the level of services for the public projects may be lowered by the PFI because of invisibility.
- The discount rate is one of the most sensitive factors in calculating the VFM, but always controversial to set. The Guideline suggests the discount rate be set as risk-free long-term national bond rate, but in theory, a risk premium should be added to it for the risky project unless the cash flows are on a risk-adjusted basis, estimating the certainty equivalent with a risk-free scenario.

Chapter 4. Case Studies

Chapter 4 examines actual cases procured by various kinds of delivery systems in the PPP (Public-Private Partnership) context. Issues analyzed in this chapter involve organizational structure of the project, financial schemes, risk profiles and allocation, and roles and contributions of the MCFs[1]. Examined cases include Japanese traditional and privatized projects, the Confederation Bridge and Highway 407 in Canada, SR57 and SR91 in California, the Sydney Harbour Tunnel in Australia, DBFO (Design-Build-Finance-Operate) roads in the U.K., and two primary Japanese PFI projects. Most of the cases are of toll roads, bridges, and tunnels, so that the analyses in this Chapter can be extended in the following chapters on these topics.

Although the description formats of the case studies are not necessarily consistent with one another due to incomplete information of the cases, some important features are listed in tables and comparative analyses are made in Section 4.3.

4.1. Introductory Remarks

4.1.1. Objectives of the Case Studies

The two objectives of the thesis are to provide a PFI framework for Japan's toll road/bridge/tunnel project as an example and to propose some strategies of a MCF to face the Japanese PFI. A toll road/bridge/tunnel project following the PFI scheme, which has the four elements ("in Japan," "toll road/bridge/tunnel," "private," and more specifically,

[1] "Major Construction Firms" is defined in Section 2.2.1.

"Japanese PFI") has not yet occurred in Japan. In this regard, this chapter tries to capture the proxy model of Japanese toll road PFI projects by filling in the surrounding moat.[2]

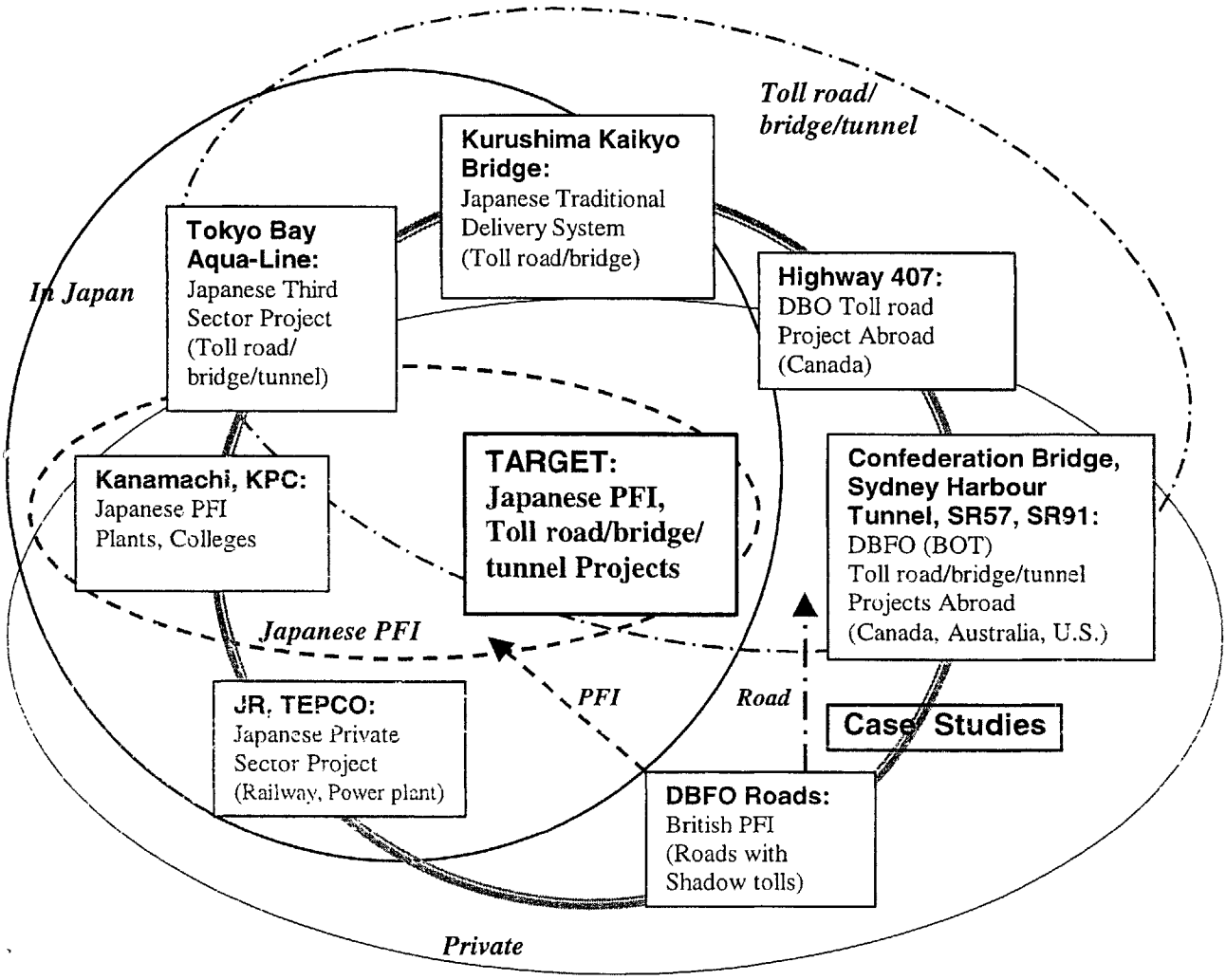


Figure 4-1 Image of the Objective of the Case Studies

Figure 4-1 illustrates the concepts, or the objective of the various case studies. That is to say, understanding traditional Japanese projects, represented here by the case study of the Kurushima Kaikyo Bridge, is important to analyze the trends and issues of the domestic delivery system toward the PFI; Cases abroad (examples depicted outside of "In Japan" circle, such as Highway 407, Confederation Bridge, and DBFO roads) may suggest

[2] In addition to the case study analyses, Chapters 5 and 6 establish a framework and strategies with a theoretical approach and apply them to a prospective case in order to demonstrate their viability.

many insights that can be adapted in Japan; Japanese private sector projects, such as ones of Japan Railway and Tokyo Electric Power Company, may provide some restrictions of the PFI scheme due to the public purpose of the PFI; and pioneer Japanese PFI projects (Kanamachi Co-generation Plant and Kanagawa Prefectural College) may raises difficulties or improvements for introduction of the PFI scheme.

In **Figure 4-1**, the four elements that comprise the target project type, toll road/ bridge/tunnel projects by the Japanese PFI scheme, is shown by different ovals, within which pertinent cases are located.

4.1.2. Risk Profiles of the Toll road/bridge/tunnel Project

In order to study risk management, project financing, organizational structures, and roles of construction firms in various PPP projects for a toll road/bridge/tunnel in the world's developed countries, this subsection surveys general risk profiles of the toll road/ bridge/tunnel project. Main risks include pre-construction, completion (construction), demand (traffic volume), force majeure, tort liability, political, and financial risks.[3]

Pre-construction Risk. Right-of-way acquisition, environmental compliance, regulatory permissions, and other project requirements before the construction period may cause delays and cost overruns during project development. While the public sector often takes the responsibility for acquiring the right-of-way, the private sector tends to be responsible for the others in many privatized projects. Pre-construction risk may involve objection from the residential circumstances.

Completion (Construction) Risk. During the construction period, design changes, unforeseen geological and weather conditions, the difficulty of adapting an innovative technology, and the unavailability of materials and labor can cause delays and cost overruns. The private sector typically takes primary responsibility for cost overruns and delays during the construction period and allocates the risk to the contractor through a fixed price contract except for in the case of force majeure. The public sector also takes some responsibility for completion risks associated with public control, such as the development of the connecting road network or those that cannot be completely attributed

[3] Fisher and Babbar (1996). "Private Financing of Toll Roads," *The World Bank RMC Discussion Paper Series 117*

to the private sector, such as unforeseen geological conditions. Construction risks may be lower for extensions, expansions, or rehabilitations than for new projects.

Demand (traffic volume) Risk. Demand risks may be the greatest risk for toll road projects (Completion risks may also be great as well for bridge/tunnel projects). These risks are associated with insufficient traffic levels and toll rates too low to generate expected revenues. The private sector assumes the risk to the full extent in some projects, while the government provides a minimum traffic or revenue guarantee in others. To mitigate the risk, some relatively new projects adopt the congestion pricing system, or the government gives incentives for the quality of services such as high occupancy rate and safety improvements.

Force Majeure Risk. Force majeure involves risks beyond the control of a project's public and private partners such as earthquakes, floods, storms, or war. These impair the facility's ability to generate earnings. Since neither the public sector nor the private sector can control the risk, they often jointly assume it. For example, the public sector may extend the concession to allow the private sector to recover from the event. When a private insurance is available, and it is usually the case for earthquakes, the private sector may purchase (or be required to purchase) the insurance to transfer the risk.

Tort Liability Risk. Tort liability relates to the risk of having to pay substantial legal awards as a result of accidents on the toll road/bridge/tunnel. This risk rarely seems to be large in Japan.

Political Risk. Political risk concerns government actions or policy changes that could impair a facility's ability to generate earnings. The government may change laws that govern the concession or taxes or regulations on the project that severely damage its value. The change of powers may suspend the government supports and may not allow the private sector to charge and collect tolls as specified under the agreement or to settle contract disputes fairly under a neutral resolution system. Governments generally agree to compensate the project company for termination of the concession and violation of the concession agreement, including agreed toll rates. However, private concessionaires generally assume the risk associated with dispute resolution and the ability to obtain compensation in the event of a government violation of the concession agreement.

Financial Risk. Financial risk is defined as the risk that project cash flows may be insufficient to pay an adequate return on the private debt and equity invested in the project. Financial risk stems generally from the project itself due to the inadequate structuring; however, it may involve an economic risk, such as changes of consumer price or interest or a partner's default. It may also include the operation risk, or inefficient operations. The private sector is generally responsible for financial risk, although in some cases governments may provide debt guarantees. Governments also may provide cash grants, equity, and return on private capital invested.

In the following case studies, risk profiles and allocation from the perspective of the project company are most stressed in terms of financial schemes. Roles of the construction firms in the projects are also examined in some cases.

4.2. Case studies[4]

4.2.1. Kurushima Kaikyo Bridge

This subsection introduces the Kurushima Kaikyo Bridge project, which the author engaged in for a substructure construction, together with the Honshu-Shikoku Bridge Authority's other projects, as an example of the traditional Japanese delivery system of construction projects for a basis of comparison with other cases in this chapter.

1) Project Outline

The Kurushima Kaikyo Bridge consists of three successive suspension bridges, the First, Second, and Third Kurushima Kaikyo Bridges, comprising the Nishi-Seto Expressway, the connecting route between Onomichi and Imabari Cities, which is one of the three Honshu-Shikoku (Japan's main islands) connecting routes in Western Japan. The Bridge has a total length of 4,105m (center spans are 610m, 1020m, and 1030m) and is the world's first three-successive suspension bridge. (See **Figure 4-2**, **Figure 4-3**.)

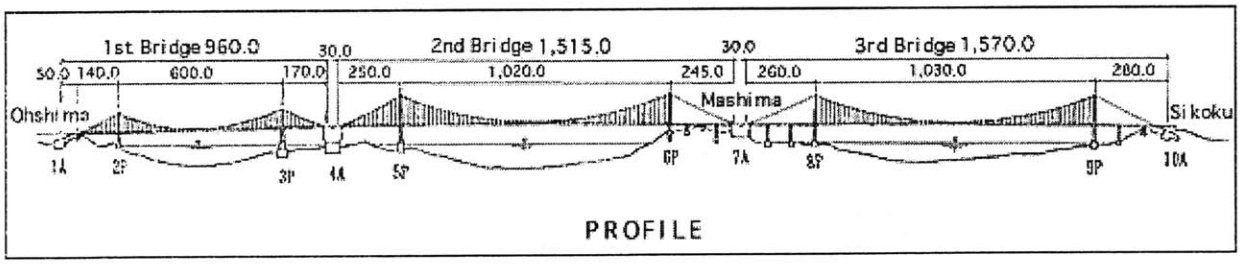


Figure 4-2 Profile of the Kurushima Kaikyo Bridge (Unit: m, Source: HSBA)

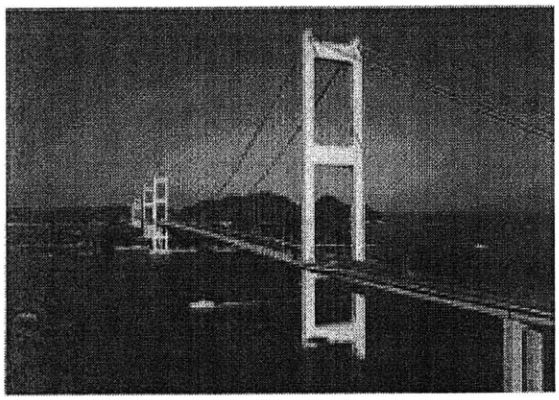


Figure 4-3 The Kurushima Kaikyo Bridge seen from Shikoku side (Photo, Source: HSBA)

[4] For the case studies, a currency rate chart, as of March 31, 2001, is provided in Appendix A for the sole purpose of convenience.

The ***Honshu-Shikoku Bridge Authority (HSBA)***, one of Japan's special public corporations, has been responsible for the delivery of the project together with other Honshu-Shikoku Bridges, which include the Seto-Ohashi Bridge and the world's longest bridge, the Akashi Kaikyo Bridge. The HSBA opened the Kurushima Kaikyo Bridge, the last major project of the Authority, on May 1, 1999 after a construction duration of some 11 years. **Table 4-1** shows the outline of the Kurushima Kaikyo Bridge.

Table 4-1 Outline of the Kurushima Kaikyo Bridge Project

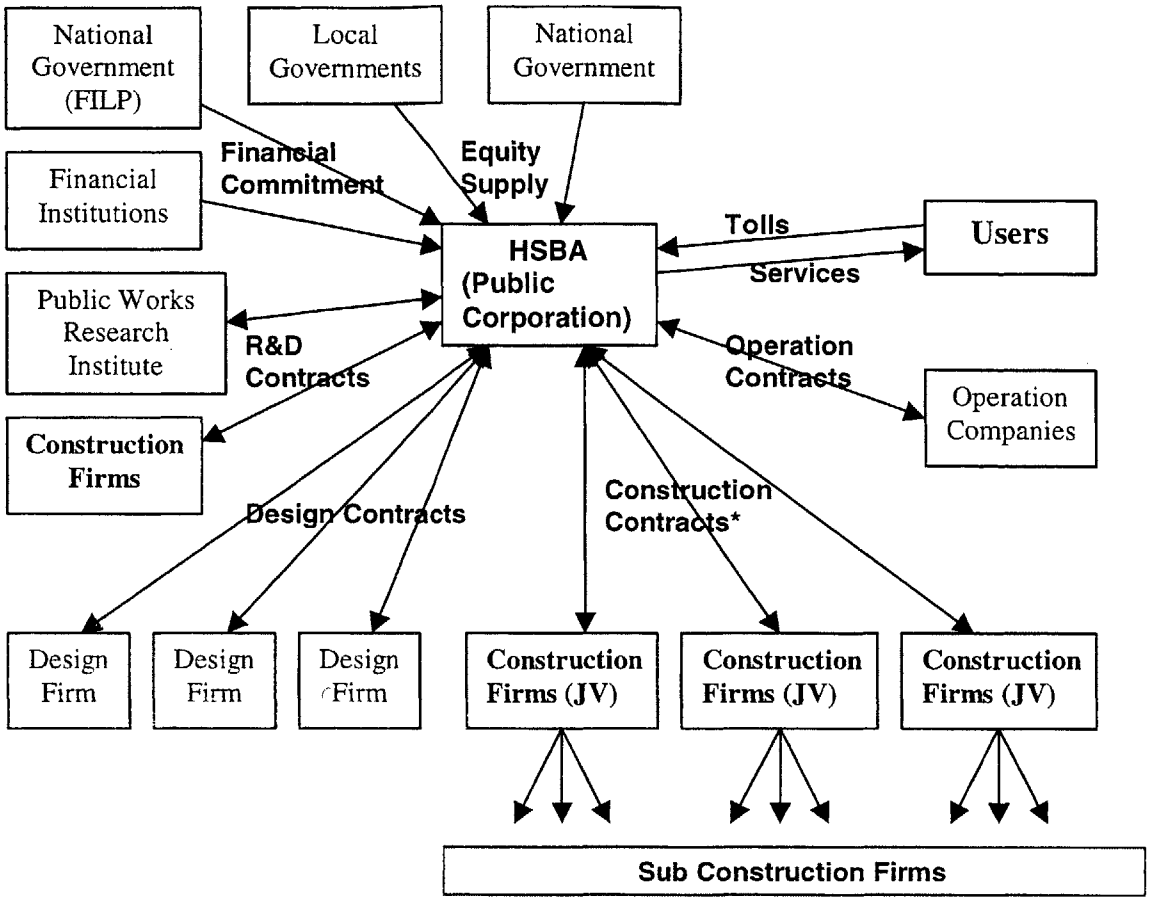
Location	Between Honshu and Shikoku Main Islands, Western Japan
Authority Concerned	Honshu-Shikoku Bridge Authority (HSBA)
Structure	Large-scale 3-successive suspension bridge, some foundations in the strong strait
Scale	4,105m, 4 lanes
Design Speed	80 km/h
Delivery System	Design-Bid-Build
Construction Period	May 15, 1988 – May 1, 1999 (Date of Opening) Construction contracts were divided into some 20 joint ventures.
Total Project Cost	¥ 280 billion (¥ 53.6 billion/km)[5]
Materials Volume and Construction Cost[6] (with numbers in parentheses)	Towers (6): 21,700 tons, ¥ 27 billion Cables (2): 16,840 tons, ¥ 44 billion Stiffening Girders: 46,060 tons, ¥ 44 billion Substructures (10): 438,450 m^3, ¥ 100 billion
Tolls for Cars	¥ 2,500 (5 years only, 20% discount rate)

2) Project Structure

Project organizational structure is as shown in **Figure 4-4**. The HSBA shows characteristics of both the public agency and the project company in the PFI scheme. Some of the differences between the HSBA and a private project company are that the HSBA does not seek profits and that the HSBA is neither a design, finance, construction, nor operation arm and it works with those firms separately, while a private project company is usually the aggregation of those.

Table 4-2, the procedure of the implement of the Kurushima Kaikyo Bridge project, demonstrates the essential roles of the HSBA.

[5] US$1= ¥126 as of March 31, 2001.
[6] Nikkei BP (1997): Big Project, *Nikkei Construction* Special Issue



(Note) Construction contracts consisted of some 20 main JVs.

Figure 4-4 Organizational Structure of the HSBA Project

Table 4-2 The Procedure of the Implementation of the Kurushima Kaikyo Bridge Project

(Source: HSBA Brochure)

Date	Procedure
1955-1970	Investigation of the Honshu-Shikoku Bridges by Ministry of Construction, Japan National Railways, and Japan Railway Construction Public Corporation
May 1969	Settlement of the three routes of the Honshu-Shikoku Bridges
July 1, 1970	**Establishment of the Honshu-Shikoku Bridge Authority**
	(HSBA) Surveys and Initial design, Detailed design, Financial arrangement, and Right-of-way acquisition
September 21, 1973	Order of generic construction plan by Ministers of Construction and Transport
October 26, 1973	Approval of construction implementation plan by Ministers of Construction and Transport
November 20, 1973	Suspension of the ground-breaking as a part of aggregate demand-control policy
	(HSBA) Additional surveys, Detailed redesign, Financial rearrangement, and Right-of-way acquisition
December 27, 1987	Agreement of the implementation of the Kurushima Bridge among the National Land Agency, the Ministry of Transport, and the Ministry of Construction
	(HSBA) Preparation of contracts
May 15, 1988	Ground-breaking of the Kurushima Bridge project
	(HSBA) Supervision of the construction, Financial arrangement, and Additional right-of-way acquisition
May 1, 1999	Opening
	(HSBA) Maintenance and Operation

3) Financing Scheme

The toll road system in Japan, including the Honshu-Shikoku Bridges, is financed by debt and the government investment, which are repaid by tolls from users. The account of the Honshu-Shikoku Bridges is combined and the tolls are pooled together. The financing structure is similar to that of other toll road systems, such as those operated by Japan Highway Public Corporation.[7] Therefore, the Agency's financial scheme, instead of the single project, is discussed in the following. The toll rate is set according to two basic concepts as described below: redemption and benefit principles.

[7] The toll road financing system in Japan is introduced in Section 5.2.1 in great detail.

Redemption principle. Tolls are set such that the total revenues from tolls redeem total costs (construction, operation and maintenance, and interest of debts) of the toll road system during a certain redemption period.[8]

Benefit principle. Tolls are set such that users' total costs to use the Honshu-Shikoku Bridge, taking into account the effect of time saving by doing so, do not exceed those to use the conventional transportation services, such as ferry service.

The HSBA's balance sheet and income statement of FY1999 [9] are shown in **Table 4-3** and **Table 4-4**.[10] In principle, new construction of the motorways is financed by debt and government investment and the costs for operations and interest on the debt are paid from user tolls. In 2000, however, while all three routes of the Honshu-Shikoku Bridges had been completed, the revenue from the tolls was insufficient even to repay the interest alone, and accumulated debt service and carryover deficit reached ¥3,866 billion and ¥923 billion, respectively, as of March 31, 2000.[11] Since the toll revenue cannot solely pay the debt service, the government still invested ¥80 billion and the Treasury Loan and Investment[12] was utilized for the issuance of the HSBA bonds and loans of ¥284 billion in FY2000. Two-thirds of the total investment is funded by the national government and the rest is divided and funded by local governments that benefit from the bridge project. (**Table 4-5** shows the sources and uses of the HSBA's funds during FY2000.) The investment of the governments will continue until FY2012. More than half of the fixed liabilities of ¥3,839 billion are funded by the Treasury Loan and Investment Program[13], and other fixed liabilities issued by private financial institutions may also be supported by the same program indirectly. Construction firms have never invested in public works.

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[8] The term was revised and prolonged to 50 years for the Honshu-Shikoku Bridges.

[9] A fiscal year (FY) starts April 1 of the year and ends March 31 of the next year in Japan. Namely, the end of FY1999 is March 31, 2000.

[10] According to the special laws for toll road operating agencies, the accounting formats are made differently from those of commercial companies.

[11] The level of toll revenues are some 70% of the projection.

[12] The Treasury Loan and Investment is a fund from government-operated businesses, such as Postal Savings and Postal Life Insurance.

[13] TLIP has funded ¥2,160 billion out of the total liabilities of ¥3,839 billion.

Table 4-3 HSBA's Balance Sheet as of March 31, 2000 (Source: HSBA)

	in ¥ billion	
Assets		
Current assets	9	0.2%
Fixed assets, Motorways	3,538	98.1%
Motorways, construction in progress	22	0.6%
Other fixed assets	24	0.7%
Deferred assets	15	0.4%
Total	3,608	100%
Liabilities and Capital		
Liabilities		
Current liabilities	27	0.7%
Fixed liabilities		
HSBA Bonds	3,549	98.4%
Long-term Loans	284	7.9%
Others	6	0.2%
Subtotal	3,839	70.3%
Total Liabilities	3,866	106.4%
Capital		
Government investment	665	18.4%
(Deficit)	(923)	(25.6%)
Total Capital	(259)	(7.2%)
Total	3,608	100%

Table 4-4 HSBA's Income Statement for the Year Ended March 31, 2000 (Source: HSBA)

	in ¥ billion	
Revenues		
Toll revenues	86	91.3%
Others	1	0.3%
Deficit during FY1999	85	
Total	173	100%
Expenses		
Operating expenses	15	14.1%
General administrative expenses	9	4.6%
Non-operating expenses		
Interest on bonds and borrowings	147	37.3%
Others	2	2.7%
Total	173	100%

Table 4-5 HSBA's Budget for FY2000 (Source: HSBA)

in ¥ billion

Sources			
	Investment from governments	80.0	17.2%
	Debt	284.2	61.3%
	Revenue from Operation	89.9	19.4%
	Other Revenues	9.7	2.1%
	Total	463.8	100%
Uses			
	Operation of Roads	21.7	4.7%
	General, Administrative Costs	13.0	2.8%
	Debt Service Payments, etc.	428.0	92.3%
	Construction and Investigation	0.1	0.0%
	Total	463.8	100%

4) Risk Profiles and Allocation

In the traditional Japanese project scheme, the public sector basically takes all the risks involved. The following items in **Table 4-6** are characteristics of risks involved and the allocation in both traditional Japanese projects in general and the Kurushima Kaikyo Bridge project specifically. In the table, ○ denotes the main responsibility and △ denotes the secondary or partial responsibility for the risk. These denotations are consistent through the case studies.

Table 4-6 Risk Description and Allocation for the Kurushima Kaikyo Bridge and the Traditional Delivery System

Risk Type	Description	Public	MCFs
Pre-construction Risk	Right-of-way acquisition, environmental compliance, regulatory permissions, and other project requirements before the construction period are all public sector's responsibility.	○	
Completion Risk	Construction firms contract a project basically on a lump-sum basis. They rarely claim changes because of uncertainties or incompleteness of the contract, and they work in a very responsible manner. However, the owner has the ultimate responsibility for the completion and, if the owner is a national-level agency, often accepts change claims from the contractor that is about to overrun the cost. In terms of the construction durations, the contractor always makes the best efforts to avoid delay.	○	△
Market Risk (Demand Risk)	Demand risk is always borne by the public owner, or the taxpayers, in the traditional Japanese project because the owner operates the project such as toll roads. However, if actual traffic volume is less than anticipated, the public agency may increase the tolls or the government may financially support the project by utilizing additional taxes, and the users or taxpayers may ultimately pay for the risk.	○	
Force Majeure	This risk is eventually assumed by the public sector except for the case of minor incidents.	○	
Political Risk	Once a contract is made, a suspension and cancellation had rarely taken place in the past.	○	
Financial Risk, Operation Risk	The public owner always bears the operation risk because government agencies exclusively operate bridges and toll roads in Japan. Even in the PPP projects, the ownership is kept in the public sector. The government budgets for maintaining and constructing the bridges and roads and cannot default, at least in a general sense, in Japan.	○	

5) MCF's Roles

From the contractor's viewpoint, MCFs' technical inputs are greatly necessary for, but not limited to, the HSBA, in particular when the project is challenging, in order not to overlook important, but unusual matters. For example, the installation of a caisson in the middle of the strait was a technically critical task for the project. A "guide pile," a target to install the caisson, was designed in order to ease the location of the caisson and to shorten the installation time. However, the guide pile setting was another difficulty because of the site conditions: the strong current, the stiffness of the seabed, and heavy pile weight. Kajima, an MCF in Japan, developed a construction method to utilize its self-elevating platform *(SEP) "KAJIMA,"* which can load all necessary equipment such as a crane and

materials, coupled with careful, detailed schedule planning. This proposal eventually made the project technically feasible.

Non-segregating underwater concrete was another requirement for the success of the project. MCFs had just developed the concrete and utilized it for the Kurushima project as well as a precedent project, the Akashi Kaikyo Bridge.

The author proposed, from a perspective of a contractor, a new analytical method that enabled reasonable evaluation of the stability of a caisson, which is a prefabricated steel form (sometimes concrete form) to set on the seabed as a component of the foundation. When the caisson was installed in a strong current, since the caisson is not heavy enough to resist the current, it is sensitive to the current force to rotate if its shape is not circular. The result of this analysis was one of the important reasons why only one caisson's shape was determined to be circular among five undersea foundations of the Kurushima Kaikyo Bridge. For a contractor, such a voluntary examination was an effort to prepare for the actual construction work and to feel comfortable if the contractor eventually gets awarded the bid.

Example in Other Traditional Japanese Public Projects

Examples in which MCFs played important roles other than those in mere construction works as specified in tender drawings have taken place on a number of occasions for technically complicated public (and private) projects.[14] For instance, Kajima recently resolved a complicated problem in the Ujigawa Bridge project, where the MLIT managed the entire project. The severe construction time limit, due to the availability restriction of the site to the only 8-month dry season, had been the most serious problem from the outset, when Kajima got awarded the project. Kajima proposed to the MLIT various design changes to adapt Kajima's cutting-edge technologies, such as New-SRC Structure for a pier and AQ Form, precast concrete forms, so that the construction work on site could be drastically facilitated.[15] In this case, Kajima provided a detailed design of the proposal, although it was not obligated to, even though its original drawings were unrealistic in terms of constructability with the time restriction.

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[14] Chapter 2 introduced more this issue.

[15] Kajima (2001): "Expeditious construction by precast 'AC Form'," *Kajima200103*

4.2.2. Tokyo Bay Aqua-Line[16]

1) Project Outline

Tokyo Bay Aqua-Line is a toll road across the Tokyo Bay connecting Kawasaki City in Kanagawa Prefecture and Kisarazu City in Chiba Prefecture with a length of 15.1 km. It consists of both tunnel and bridge sections. The western portion is a 10 km shield tunnel, while the eastern portion is an approximately 5 km bridge. There are two man-made islands: Kawasaki Man-made Island, which stands at the center of the tunnel section, both as a ventilation shaft and as a starting shaft of the shield tunneling, and Kisarazu Man-made Island, which is located between tunnel and bridge sections. (**Figure 4-5**)

This project, which is the largest marine civil engineering project ever attempted, incorporates the most advanced technology at every stage of design and construction. **Table 4-7** shows the outline of the Tokyo Bay Aqua-Line.

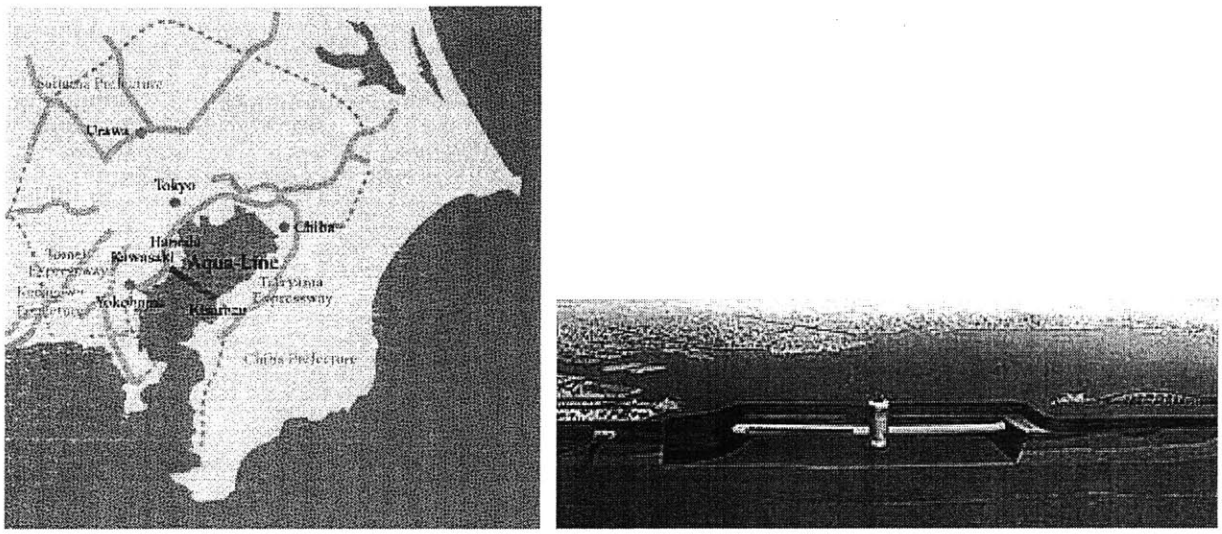

Figure 4-5 Location and Overview of the Tokyo Bay Aqua-Line (Source: www.aqua-line.com)

[16] Before its completion, the Tokyo Bay Aqua-Line was known as "Trans-Tokyo Bay Highway," which is also the official name of this toll road.

Table 4-7 Outline of the Tokyo Bay Aqua-Line Project (Source: TTB, "Trans-Tokyo Bay Highway")

Location	Between Kawasaki, Kanagawa and Kisarazu, Chiba, Japan
Authority Concerned	Construction: Trans-Tokyo Bay Highway Corporation (TTB) Operation & Administration: Japan Highway Public Corporation (JH)
Scale	10km tunnel, 4.4km bridge, 4 lanes (6 lanes in the future)
Structure	Four 13.9m diameter shield tunnels (14.14m diameter machine), 4.4km continuous bridge, two man-made islands in the middle of Tokyo Bay
Design Speed	80 km/h
Delivery System	Design-Bid-Build (Build-Transfer-Operate (BTO) for TTB)
Project Company	Trans Tokyo Bay Highway Corporation (TTB)
Construction Period	May 1989 – December 1997 Construction contracts were divided into 61 joint ventures.
Total Project Cost	¥ 1,482 billion (¥ 920 billion for construction) TTB: ¥1,266 billion, JH: ¥216 billion
Tolls for Cars	¥ 3,000 (Since July 20, 2000 until March 31, 2008) [17]

2) Project Structure

Trans-Tokyo Bay Highway Corporation (TTB) is the third sector, that is, it is capitalized by equity from ***Japan Highway Public Corporation (JH)***, local governments, and the private sector. Responsibilities of the project are allocated between TTB and JH as shown in **Figure 4-6**. That is, upon the completion of the construction, the ownership is transferred to JH, which is obliged to repay the construction cost to TTB, including the increase of the cost. Other administrative responsibilities, such as those for obtaining the permission and acquisition and compensation, all lie with JH.

[17] Tolls had been set at ¥ 4,000 for cars for the first 5 years and ¥ 4,900 for cars from 6th year on at the beginning. But they have been discounted due to the serious deficiency of the traffic volume.

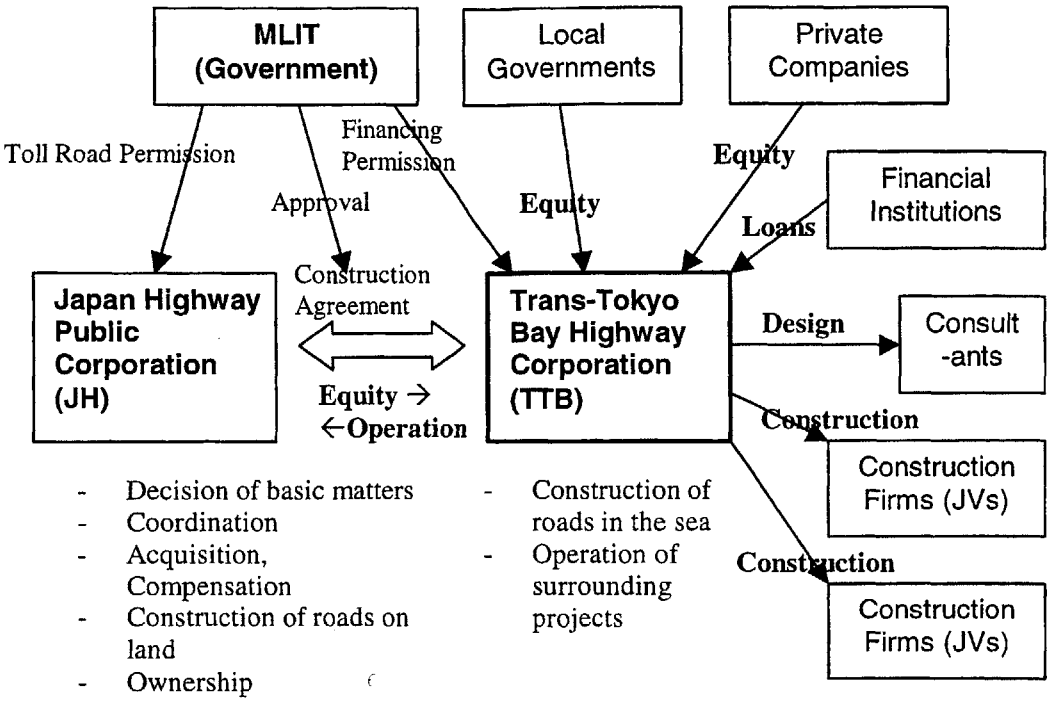

Figure 4-6 Organizational Structure of the Tokyo Bay Aqua-Line Project (Source: TTB. "Trans-Tokyo Bay Highway," amended)

3) Financing Scheme

The financing scheme for TTB is shown in **Table 4-8**.

Table 4-8 Financing Scheme for TTB (Source: TTB, "Trans-Tokyo Bay Highway")

Costs		
Project Costs	¥ 1,104 billion	87.2%
Interest during Construction	¥ 162 billion	12.8%
Total Project Cost	¥ 1,266 billion	100%
Sources		
Equity	¥ 90 billion*[1]	7.1%
Government Guaranteed Bond	¥ 584 billion	46.1%
Debts from Private Banks	¥ 217 billion	17.2%
Road Development Fund*[2]	¥ 375 billion	29.6%
Total Sources	¥ 1,266 billion	100%

*[1] Includes ¥30 billion of investments from private companies

*[2] A loan program, which both the public and private sectors fund evenly, and which is run by a public agency

Although the project is called the third sector project, or PPP project, private companies invested in the project as equity contribution less than 3% of the total cost.[18] The national government, together with several local governments, provided most of the sources by means of equity, guarantees, the road development fund, and the loan from the Development Bank of Japan (a governmental financial institution).[19]

Debts and bonds are repaid from user tolls of the road for a redemption term of 40 years. However, the traffic volume from the commencement has been approximately 10,000 vehicles per day, while the projected one is 25,000 vehicles per day, so the revenue in 1998 is merely ¥14.8 billion, while the operation cost is ¥5.6 billion and interest is ¥41.2 billion.[20] JH has restructured the redemption plan and the redemption term has been reset to 50 years, together with other changes in the financial scheme.

4) Risk Profiles and Allocations

For the Aqua-Line project, completion risk and demand risk are the two most critical risks. There is a ¥290 billion cost overrun and a couple of month time overrun besides everyday traffic volume inadequacy of about 15,000 vehicles per day.[18] These have obviously caused the extreme difficulty to repay the debt of the project. Major risks involved in the Aqua-Line project and their allocation are described in **Table 4-9**.

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[18] Bridge and Offshore Engineering Association (1998): "Finance and Project Structure of Large-Scale Projects in Japan," Working Group Report

[19] The amount of the loan is included in "Debts from Private Banks."

[20] TTB: "Trans-Tokyo Bay Highway," *Pamphlet*

In 1987, the construction cost was estimated at ¥ 1,150 billion, which would be redeemed in 30 years. Traffic volume at the commencement was originally projected at 33,000 vehicles per day at the toll of ¥4,900 for cars.

Table 4-9 Risk Description and Allocation for Tokyo Bay Aqua-Line Project

Risk Type	Description	JH	TTB	MCFs
Pre-construction Risk	Right-of-way acquisition, environmental compliance, regulatory permissions, and other project requirements before the construction period are all public sector's responsibility.	○	△	
Completion Risk	Construction firms contract a project on a lump-sum basis. Though they work in a very responsible manner, and even though the contractors are contributing as equity providers, they may try to get change orders for the increase of the total contract price so that the profit from the construction work will more likely generate the margin that will cover the equity contribution. However, TTB had the ultimate responsibility for the completion and often accepted change claims from the contractor because the claims were reasonable in spite of the previous cooperation from the same contractors. In terms of the construction durations, the contractor always made the best efforts to avoid delay, but the limit was deferred due to an incident without explicit penalty to the contractor in TTB project.	○	△	△
Market Risk (Demand Risk)	As JH owns and operates the Aqua-Line, as illustrated in **Figure 4-6**, the demand risk, or traffic volume risk, is primarily assumed by JH. If traffic volume is less than expected, JH would borrow the deficit additionally from the Governmental sources and repay the principal and interest of the debts. As long as the Government permits, JH could finance the deficit by some Governmental sources, and therefore the taxpayers ultimately cover the demand risk. In reality, the traffic volume has been far below the expected amount, so the financial scheme was revised such that toll revenue stream during 50 years will repay the debt. This means that future generation will pay for the project in return for the benefits they will obtain.	○		
Force Majeure	This risk is eventually assumed by the public sector except for the case of minor incidents.	○	△	
Political Risk	Once a contract is made, a suspension and cancellation are unlikely to take place.	○	△	
Financial Risk, Operation Risk	Even in the PPP projects like the Aqua-Line project, the ownership is kept in JH, or the public sector.	○	△	

5) MCFs' Roles

As always in major, complicated public infrastructure projects, almost all Japanese MCFs had researched and developed cutting-edge technologies solely for the project such as various shield technologies (full automated system, underground docking, and so on) for the extremely large, deep, and long Kawasaki Tunnels, the 4.4 km Kisarazu Bridge

structure, and huge soil improvement for Kawasaki Man-made Island.[21] Even though the state-of-the-art technologies are extremely expensive, they are still essential for the project. Under this circumstance, and because only the MCFs have the capabilities for the innovation, MCFs are involved in the project from planning stages, explicitly and implicitly.

MCFs also contribute equity for TTB, but the amount they invest is small enough (¥30 billion from 351 firms, supposedly less than ¥100 million at the most) to be covered with the profits they may earn from the construction contracts. Even as the owner of TTB, MCFs do not have to consider the profitability of the project itself, and, in fact, they claim for changes, which deteriorated the profitability.

6) Problems of the Third Sector Model

The Tokyo Bay Aqua-Line project, then Trans-Tokyo Bay Highway, is implemented as the third sector project and cannot be assumed successful due to the ¥290 billion construction cost overrun and the serious shortfall of the traffic. The third sector projects, in general, as well as the Aqua-Line project, have following inherent problems:

- As the public sector is, by nature, expected to exercise the leadership from the outset, the third sector does not usually take into account the utilization of the private sector's creativity and originality.
- Because the public sector is usually responsible for the project planning, management, and operation control, the project tends to be inefficient in the absence of competition.
- The revenue projection tends to be optimistic because the primary objective of the third sector is often to implement the project, expecting governmental backup if the project fails or becomes serious situation.
- It tends to be unclear who takes risks and responsibilities between the public and private sectors in the project.

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[21] TTB: *Technical Pamphlets*
The tunnels have 13.9m diameters and locate 40m below the seabed. Eight shield machines were used to make the two alignments with Kawasaki Man-made Island in the middle as the starting shaft. Kawasaki Man-made Island is a cylindrical structure, with 98m diameter and 74m heights, and with a 114m deep diaphragm wall.

4.2.3. The Confederation Bridge in Canada[22]

The Confederation Bridge[23] (**Figure 4-7**) has replaced the ferry by spanning the Northumberland Strait at its narrowest point, a distance of some 13 km. The C$840 million[24] project was the first major infrastructure project undertaken by the government of Canada using a Build-Own-Transfer (BOT) process.

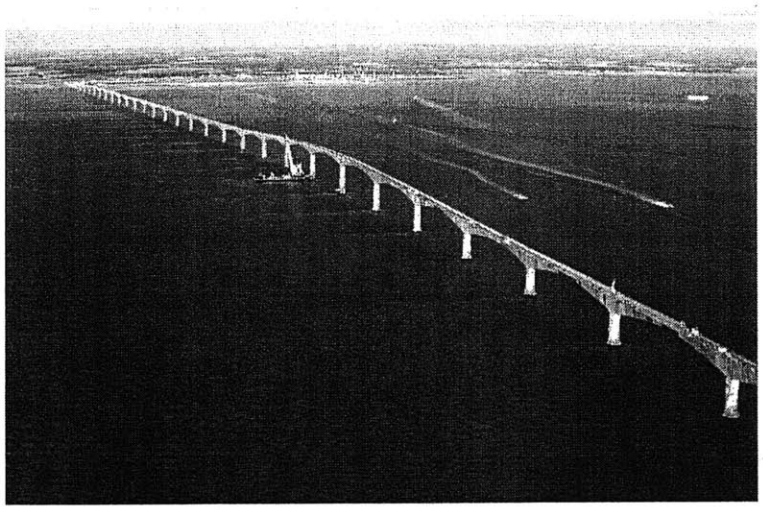

Figure 4-7 The Confederation Bridge (Photo, Source: SCDI)

1) Project Background and Outline

The 12.9-kilometer Confederation Bridge, which opened on May 31, 1997, connected Prince Edward Island (PEI) and New Brunswick in Atlantic Canada, and was the longest bridge over ice-covered waters in the world. (**Figure 4-8**) The Bridge was privately financed, designed, built, maintained and operated by ***Strait Crossing Development Inc. (SCDI)*** and its subsidiary companies.

PEI became a part of the Canadian confederation in 1873. Under the terms of its entry into the confederation, the Government of Canada agreed to provide a continuous and efficient year-round transportation facility for goods, services, and people between the island and the mainland. Operating subsidized ferry services between the island and two points of the mainland was discharging this responsibility. Over the years, there had been a

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[22] Much information in this subsection is cited from Feltham (1994): "The Northumberland Strait Crossing Project," *Strait Crossings 94*; Pirie (1994): "The Northumberland Strait Crossing Project, Financing Options and Solutions," *Developments in Short and Medium Span Bridge Engineering '94*; and Pirie (1997): "The Confederation Bridge: project structure and risk," *Canadian Journal of Civil Engineering*, Vol.24, 6

[23] It was better known as the Northumberland Strait Crossing Project (NSCP) during the construction periods.

[24] For the convenience purpose, US$1= C$1.58 as of March 31, 2001.

modest annual growth of around 3 to 4% in the traffic carried. Operation of the ferries had been an expensive proposition for the government with the future projections being of increased government spending on the aging fleet, which required repairs and modernization. In 1992, the Government spent approximately C$ 42 million subsidizing these ferry operations, and these subsidies rose at a rate approximately 15-20 % higher than the Consumer Price Index (CPI). The magnitude of future expenses and continuing subsidies was of concern to the Government.

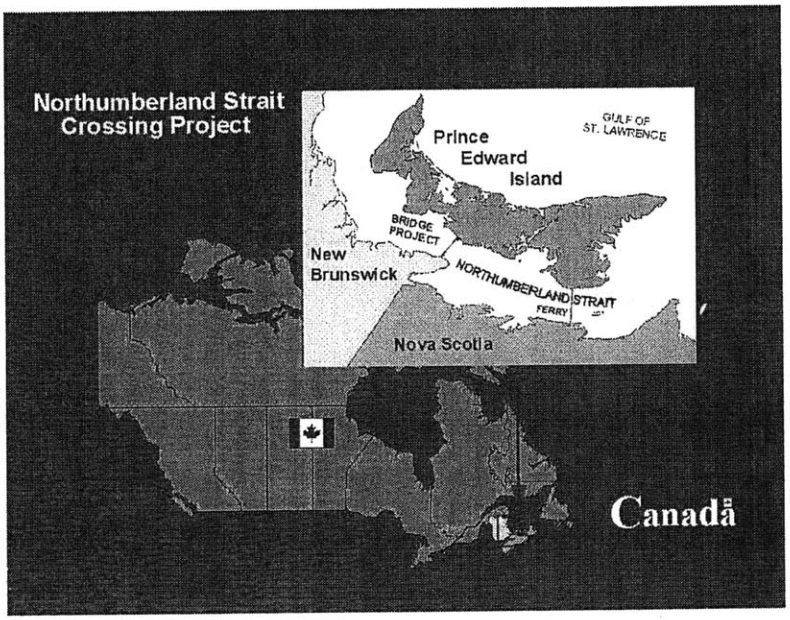

Figure 4-8 Location of the Confederation Bridge (Source: SCDI)

Table 4-10 Outline of the Confederation Bridge Project

Location	Between Prince Edward Island (PEI) and New Brunswick in Atlantic Canada
Authority Concerned	The Government of Canada
Structure	Continuous precast concrete bridge with foundations in the ice-covered sea
Scale	12.9 km, with maximum 250m spans, 2 lanes
Design speed	80 km/h
Delivery System	Design-Build-Finance-Operate (DBFO)
Project Company	Strait Crossing Development Inc. (SCDI)
Construction Period	42 months (November 1993 – May 1997)
Concession Period	35 years
Total Project Cost	C$840 million (in 1992 Dollars)
Design Life Time	100 years
Tolls for Cars	C$37.00 for round trip

In the Confederation Bridge project, the Canadian government partially subsidized the project, by means of a payment equivalent to the ferry service expenses, since the ferry service was terminated upon the bridge's operation. **Table 4-10** shows the outline of the project.

2) Project Structure

Procurement Process

Procurement process consisted of six stages as follows.

(a) First Call, Stage I (1987). The Government of Canada decided to use the Build-Operate-Transfer (BOT) approach and invited the private sector to design, construct, finance, and operate a fixed crossing. Out of 12 submissions, seven proposals were selected for the second call.

(b) Second Call, Stage II (1988). Out of the seven, three proposals were evaluated by the stated criteria in the five main categories of requirements: technology (the built work); management; environmental planning; maximization of regional benefits; and financing, including the security package.

(c) Environmental Assessment Stage (1987-1992). In January 1987, the Federal Environmental Assessment Review Office (FEARO) established an environmental assessment of the fixed-link project. This assessment turned out to be a long-term process, which ultimately caused a substantial delay in the final contract.

(d) Financial Call, Stage III (1992-1993). This process followed the Environmental Assessment Stage and ended at the Closing Day, which was settled as the day when the contract was set. The government had set a price cap for the bid of no more than C$42 million in 1992 Canadian dollars. SCDI was the only bidder that submitted the bid under the cap. Basic financial agreements were also set in the contract.

The final award was made in this Stage. First, it was based on the compliance with the previous requirements and the additional recommendation by the environmental panel, and second, the pricing. In fact, awarded was the only consortium that met the government's financial requirement, which limited its subsidy no more than the ferry operating cost.

(e) Construction Stage (1993-1997). This stage commenced on contracting closing day (Oct. 7, 1993) and ended on the date of final completion (May 31, 1997). SCDI agreed

to complete the construction within four years at a total cost of no more than C$739 million. The Construction stage was funded in the following steps:

- First, Strait Crossing Financing Inc. (SCFI) issued a subsidy bond of C$41.9 million annually with the escalation calculated by the CPI for three years.
- Second, approximately C$660 million was placed into trusts at Closing. This fund and the interest earned during the construction stage were to fund the construction cost.

(f) Operation Stage (1997-2032). This stage started on Completion Day (5/31/1997) and ended on Revision Day. SCDI had the right and obligation to operate the project for 35 years. Important agreements included Source of Funds, Maintenance Assurance, Operating Insurance, Non-Competition Clause, Utility Corridor, and Fisheries Compensation Obligation.

Project Structure

The project structure is depicted in **Figure 4-9.** SCDI (Strait Crossing Development Inc.) is the concessionaire of the project, incorporated to act as project owner and operator of the Confederation Bridge during the 35-year concession period. Initially, in 1992, it consisted of: Strait Crossing Inc., Northern Construction Company Limited (the Canadian subsidiary of Morrison Knudsen Corporation), and G.T.M.I. (Canada) Inc. (the Canadian subsidiary of GTM International and later Dumez-GTM Group). Later, in 1994, Ballast Nedam Canada Inc. (the Canadian subsidiary of Ballast Nedam Interational B.V.) joined the consortium. Then, in 1996, Northern Construction Company Limited left the consortium. ***Strait Crossing Financing Inc. (SCFI)*** was formed by the same group as SCDI to receive the annual subsidy from the Government and to transfer the funds to a trustee for bondholder payments. ***Strait Crossing Joint Venture (SCJV)*** was established by Strait Crossing Inc. to undertake the development and ultimate design and construction of the project.

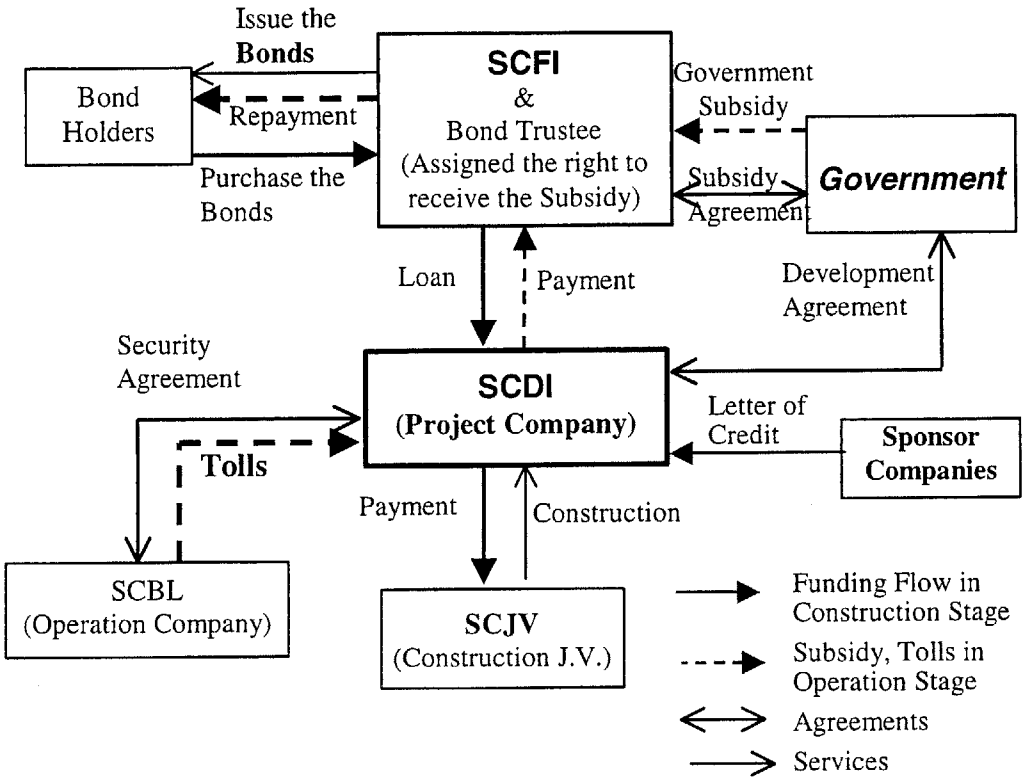

Figure 4-9 Project Structure of the Confederation Bridge

3) Financing Scheme

Figure 4-9 also shows the financing structure of the Confederation Bridge project. In short, SCFI issued the bonds, whose proceeds would be sufficient for the construction of the bridge, and the bonds would be redeemed with tolls and the government subsidy during the concession period.

Bonds and Subsidy

A total anticipated project cost of C$840 million, including 10% contingency, was funded basically by the real rate bond of C$661 million proceeds. The balance was filled in with the interest to be earned during construction and parent companies' letter of credit for the contingency. The bond was fully indexed to inflation with a guaranteed rate of return. SCFI, to which the government subsidy is paid under the Subsidy Agreement, issued the bond. The government subsidy forms annual subsidy payments that commenced on the Date Certain, May 31, 1997, whether the bridge was completed on time or not. Payments are indexed 100% to increases in the ***consumer price index (CPI)*** from the bid date of May 27, 1992. The annual payment of C$41.9 million, which was exactly the same

amount paid by the government to subsidize the ferry operation, was the only public funding to the project.

The bond discounted the future value of the 35-year stream of annual indexed payments made by the government. The structure of the bond was to pay a yield equal to 4.5% plus the annual increase in inflation. The bonds were free from construction, demand, or operation risk, and with a deflation protect, amortization of principal, and a security irrespective of any default. These allowed the SCFI bond to be rated AAA, together with the sovereign credit rating of the Government of Canada and to be issued at a rate of approximately 15 to 20 basis points above the government's own real rate bond program. This was an extremely efficient and well-priced financing instrument and ultimately enabled this project to proceed.

Tolls

Another financing mechanism was by way of a minimum floor level of toll revenue. Toll rates, together with the traffic on the ferry service of the year before the bridge opened, determined a minimum floor level of the toll revenue. This floor level was indexed 100% to increases in CPI during the 35-year concession period. If the annual increase of the toll revenue was not sufficient to equal the minimum floor level, SCDI was entitled to increase the toll rates to recapture the deficiency in the following year.

On the other hand, SCDI was allowed to increase tolls on an annual basis by a factor of only 75% of the annual increase in CPI. This would mean that toll rates would come down in real terms over the life of the agreement. There was no ceiling on the revenues SCDI could earn. The underlying assumption and expectation was that the profitability of SCDI might be huge if they operated efficiently and increased toll revenues by attracting additional traffic.

Ferry Cost Reimbursement Obligation

The government agreed to discontinue the ferry service on the date of substantial completion. If the date of substantial completion did not occur by May31, 1997, SCDI was required to reimburse the government for the government's cost of operating the ferry service.

4) Risk Profiles and Allocation

A variety of risks were well mitigated between the consortium and the government through various agreements, insurances, bond terms, and all contracts. Basically, the project company, or SCDI, bore all risks except force majeure risk for the project. The agreements about financing structure between the project company and the government were very thoughtful as shown in **Table 4-11**.

Table 4-11 Risk Description and Allocation for the Confederation Bridge Project

Risk Type	Description	Gov't	SCDI
Pre-construction Risk	Both the government and SCDI shared responsibilities for fishery right compensation, environmental compliance, regulatory permissions, and other project requirements before the construction period.	○	○
Completion Risk	The completion risk was huge because the construction method, equipment, and the structure were very unique and the site condition was very severe due to the long period of ice covering. Since the site work in the strait was restricted for four months every year, a small trouble could delay the completion for a long time (at least four months). Cost overruns, if any, were the responsibility of the project company. A very extensive security packages, comprising joint and several parent company guarantees, a C$200 million performance bond, and a C$20 million labor and material payment bond, were supplied to protect the government.		○
Market Risk (Demand Risk)	Sales revenue was the only source of the cash flow of the project company, for all the government subsidy went to the real rate bondholders. Market risk nearly equaled to the risk of the traffic volume in the project. This demand risk was wisely mitigated for each party by setting the minimum floor level. In addition, according to the non-competition clause, the government stopped the ferry service and would not provide any financial assistance to anyone to run a crossing service within 25 km of the bridge.	△	○
Operation Risk	SCDI should deposit all toll revenues to a toll revenue segregated account to be used for certain express purposes, including the settlement of funds in a maintenance trust. Also, SCDI should have a C$5 million maintenance assurance by way of a letter of credit to secure SCDI's undertaking of the required maintenance.		○
Force Majeure	Acts of the Queen's enemies, nuclear events, government action, environmental injunction, and, sabotage and terrorism were described in the agreement as force majeure risks, which the government took. SCDI took the risk up to the amount of C$200 million, which was transferred by the insurance coverage.	○	△
Political Risk	The government basically assumed political risks.	○	△
Financial Risk	The project company's repayment obligation was secured by priority charges on certain project assets and distribution of toll revenue, certain financing proceeds, and by parent guarantees, together with several insurance and bonds to mitigate risks. The government also required a separate letter of credit for C$73 million to be set aside as extra protection against cost overruns.		○

5) MCFs' Roles

The project company contained four construction firms only. Therefore, the MCFs were fully responsible for the whole project. As described above, the construction firms bore nearly all of the completion, operation, and financial risks, and most of the demand risk.

The MCFs contributed to this project to an extremely large extent in order to overcome the severe construction condition. For example, the design of the bridge utilized a multi-span concrete box girder structure. Comprehensive design criteria for the Confederation Bridge were developed by a number of world renowned consultants specializing in areas such as wind, ice, earthquake, ship impact, load factor calibration, corrosion, geo-technical engineering and durability. Specific characteristics were, among others, as follows:

(a) For both the main bridge and the approach bridges, identical structures were adopted for as many spans as possible for the sake of cost and schedule reduction;

(b) A conical shaped ice shield was adopted to minimize the ice forces on the structure, while at the same time, facilitating the normal process of ice-out in the strait;

(c) The main bridge was made of four pre-cast concrete components, so that over 80% of the project was performed on land in order to reduce weather dependency associated with marine work, to maximize local labor skills, and to minimize disturbance to the marine environment; and

(d) To build this innovative structure as four pre-cast components, the floating crane "***Svanen***" (**Figure 4-10**) was upgraded and adapted to install the world heaviest lifted components.

Without these various innovative approaches made by the MCFs, no consortium would have met the government's criteria.

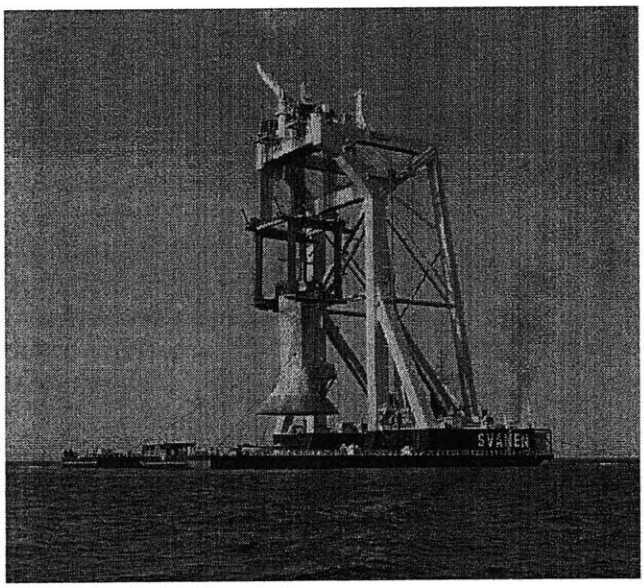

Figure 4-10 Floating Crane, "Svanen" (Source: SCDI)

4.2.4. Highway 407 in Canada[25]

This case, Highway 407 in Canada, provides insights for the PFI scheme in light of the private investment and the type of project by the unique procurement process, even though the project failed to establish a public-private partnership. Also, this project finally adopted the world's first multi-lane, fully electronic state-of-the-art toll system, which was expensive but not specified in the ***request for proposal (RFP)***. Therefore, this subsection focuses on the process with the attitudes of both the government and the private companies, rather than describing financial scheme, risk allocation, or MCFs' roles.

1) Project Outline

In 1993, the Province of Ontario decided to invite the private sector to design, build, operate, and finance the ***Highway 407 ETR project (HW407)***, which was located across northern part of Metro Toronto as an alternative route of congested Highway 401. Nonetheless, as described below, a public-private partnership was not established in this 69-kilometer project. **Table 4-12** shows the final outline of the project.

Table 4-12 Outline of the Highway 407 ETR Project

Location	Across northern part of Metro Toronto, Ontario, Canada
Authority Concerned	Ministry of Transportation, Ontario (MTO)
Scale	69km, 4-6 initial lanes
Structure	Roads with some structures, fully electronic tolling system
Delivery System	**Design-Build, Two packages (for highway itself and for operation system), Later, concession to a private entity**
Project Company	407 International Inc. (Since May 1999)
Concession Period	99 years
Total Project Cost	C$1 billion[26]
Tolls for Cars	Vary, fully electronic toll system, adopting congestion pricing, etc.

2) Project Process

Request for Proposals

Two consortia were pre-qualified after the issuance of the Request for Qualifications of May 1993. In September 1993, based upon "value engineering

[25] Much information in this subsection is cited from Office of the Provincial Auditor, Ontario, Canada (1996): "Highway 407 Central Project," *1996 Annual Report*; and MIT (1997): "Highway 407 ETR, Toronto," *Infrastructure Development Systems IDS-97-T-013*

[26] For the convenience purpose, US$1= C$1.58 as of March 31, 2001.

assessment reports" submitted by the two consortia according to independent C$1,500,000 each contracts, the ***Ministry of Transportation, Ontario (MTO)*** issued the RFP to the two consortia. In order to give the two respondents full opportunity to display their originality and creativity, the RFP did not specify such basic requirements as the highway classification, design speed in KPH, widths of pavement, shoulders, and median, the number of lanes, the type of pavement, and means of toll collection. The RFP described its policy in its objectives clause:

> "The Crown is providing the respondents with a considerable degree of latitude to propose innovative approaches with respect to the project. The full extent of the opportunities available to the respondents will be determined primarily by the experience, creativity and initiative of the respondents."

The RFP requested detailed proposals with financing, design, construction, maintenance, and operation plans of the expected toll highway 407 for 30year term. However, the RFP was vague not only as to the specification but also as to the requirement or expectation of financing and the level of service.

Business Arrangements

Business arrangements specified in the RFP included some basic principles, but the principles were implicit in terms of how MTO would put the importance on each of the principles in evaluating the proposals. The items of criteria were numerous and not limited without prioritizing. The following exemplify the principles.

(a) Forecasted traffic volume was provided, and the respondents were to base their proposals on the provided forecast, but "the risks relating to the Project must be assumed by the Respondent."

(b) The financial commitment of the government would be minimized.

(c) The proposal should include an analysis of the business plan, which contained a guaranteed maximum price for design and construction of the facility as well as a detailed cash flow model of the project.

(d) One of the evaluation criteria was the amount of equity committed at the time of submission of the proposal.

Proposals from the two Consortia

As a result, the two consortia proposed different project to a huge extent. **Table 4-13** summarizes the proposals.

Table 4-13 Summary of the Proposals from the two Consortia

Item	Group 1 Tender	Group 2 Tender
Road Lanes	4-6 initial lanes, expandable to 6-10 lanes	4 initial lanes, expandable to 8 lanes
Lighting	58 km fully illuminated, 11 km partially illuminated	Certain interchanges illuminated
Pavement	Concrete pavement (30 year estimated design life)	Asphalt 7-10 year design life, Rehabilitation begins in 2003
ETC	Mixed toll collection system, with automatic vehicle ID and manual toll booths (MFS Technologies)	Fully electronic tolling system with video-tracking (Hughes/Bell)
Schedule	Complete by 1999	Complete by 1997
Project Finance	Primarily Debt Nominal Equity Contribution Substantial Government Subsidy	Primarily Debt Nominal Equity Contribution Substantial Government Subsidy

3) Project Structure

After the evaluation of the two proposals, the government surprisingly unbundled the consortia, rearranged the package, and selected Group 1 as the Design-Build contractor for the road portion with replacing its operation team with the counterpart team from Group 2. The project was finally divided into three packages: Financing the project by the Government, Design-Build by the road team from Group 1, and Design-Build-Operate by the toll system team from Group 2. The organizational structure of the project at the time is shown in **Figure 4-11**.

The intentions of the government were that because both of the two consortia offered little equity contribution, relying almost exclusively on interest-bearing debt, it could finance the same debt less expensively than the private sector and decided to take higher quality proposals for both road and toll system portions for the sake of the Province's benefits. Especially, the Ontario government sought a state-of-the-art technology for the toll collection system.

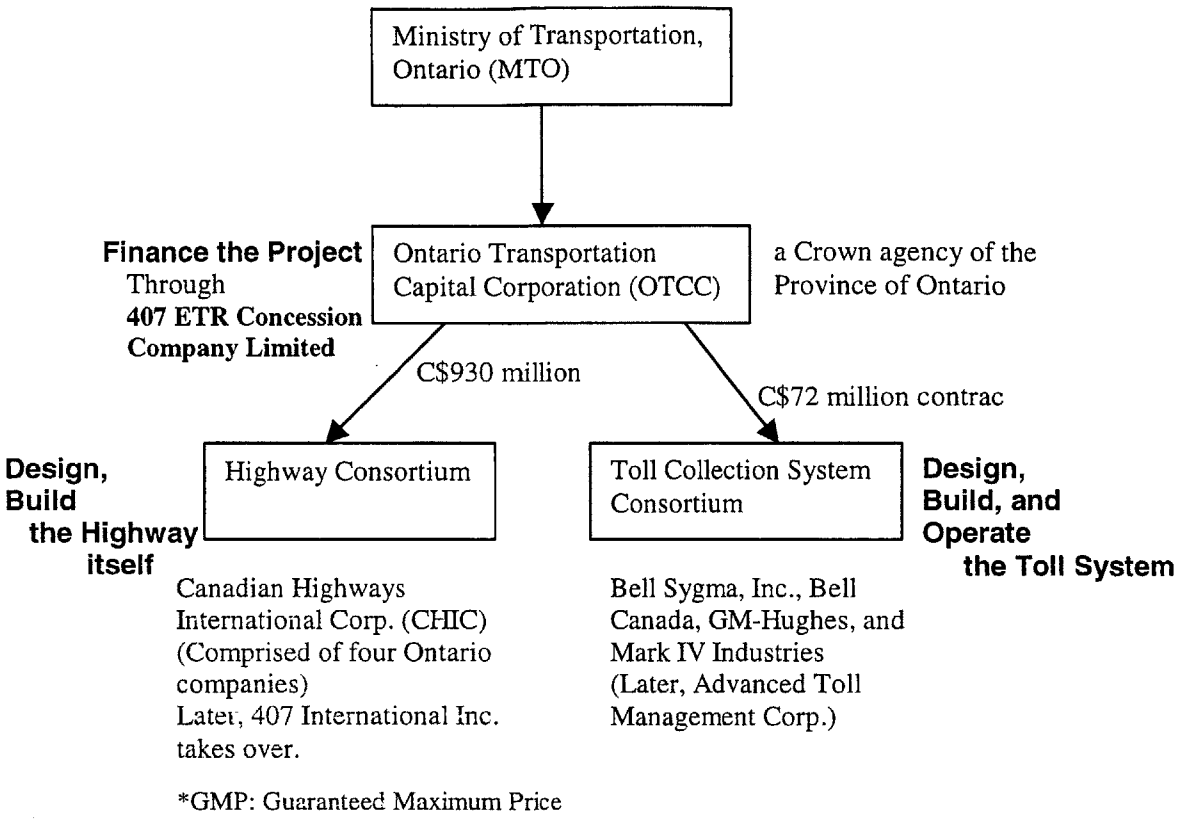

Figure 4-11 Organizational Structure of the 407 Project

4) Lessons Learned from the Project

The 1996 Annual Report issued by the Office of the Provincial Auditor made recommendations for the future projects as lessons learned from the Highway 407 project. Areas to need considerations for the Ministry of Transportation were following issues:

(a) The minimum number of bidders and design and construction alternatives needed to provide an adequate basis for decision-making. In the case of Highway 407, only two consortia submitted two design and construction proposals;

(b) The level of specific design criteria should be provided to bidders. For example, the number of lanes, type of pavement and type of illumination were not specified. MTO needed to weigh the benefits gained from providing the private sector with the flexibility to be innovative against the cost of having bids which might not be price-comparable because they were so different;

(c) The clarity of the RFP in conveying to the bidders MTO's intentions and expectations regarding the sharing of risks and rewards; and

(d) Whether components of a project that became separated or "unbundled" from the original RFP needed to be rendered separately. The removal of private financing from the project meant that MTO would be responsible for financing the project and would assume operating and ownership risks. It would have been feasible to separately tender both the highway maintenance and tolling system contracts.

Clear advantage of this procurement also appeared. Canadian Highway International Corp., the road portion contractor, claimed that it reduced C$300 million off the Province's estimate for the first 36 kilometers of the project and "much of the saving came from efficiencies like a precast plant that was set up to fabricate sections of the highway."[27] This was not the benefit from a public-private partnership but from the large packaging of Design and Build contract with Operate and Maintenance.

5) Present Status

On April 12, 1999, 407 International Inc., owned by a consortium comprised of a Spanish company and two Canadian companies[28], entered into a purchase agreement with the Province to acquire from the Province all of the shares of 407 ETR Concession Company Limited (the company established by the Province to hold the concession rights in respect of Highway 407 ETR). The acquisition (99 year concession lease) was completed on May 5, 1999 at a purchase price of approximately C$3.1 billion.[29] Advanced Toll Management Corp., a joint venture between Raytheon (merged with Hughes Transportation Management Systems) and Bell Canada (merged with Bell Sygma), is currently responsible for the toll collection system under the contract to 407ETR to supply operation and maintenance services.

The 69 km central portion of the highway has been in operation since June 1997, and construction of the expansions is expected to complete 108 km in total length. A 24 km western extension and a 15 km eastern extension are both scheduled to open in 2001.[30]

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[27] ENR (1997): "Toll Roads, Smart Highway Set for IQ Test," *ENR*, Vol. 238, No. 4

[28] Spanish company Cintra Concesiones de Infraestructuras de Transporte (100% owned by Grupo Ferrovial, 2,645 million Euro sales MCF), SNC-Lavalin Group Inc., a Canadian engineering and construction company, and Capital d'Ameique CDPQ, a subsidiary of Caisse de depot et placement du Quebec (CDP Capital, $125 billion assets fund management financial institution)

[29] Ontario Securities Commission (1997): "407 International Inc. and Nesbitt Burns Inc., RBC Dominion Securities Inc., et al., October 7, 1999" *Orders and Rulings*

[30] 407 International Inc.: "407 ETR History," *Website*, www.407etr.com

Average workday number of trips in 2000 was 263,774 (10.5% increase from 1999), almost triple of the estimation at the time of the completion of the construction, which was 90,000-100,000 vehicles a day by 2000. Income from operations in 2000 was C$125 million, also well above the projection, C$100 million.[31]

4.2.5. SR91 and SR57 in California[32]

California enacted Assembly Bill 680 (AB680) in 1989, which aimed to encourage the development of highways in the state with permission to private developers to collect tolls for up to a 35-year concession period. AB680 formed an early public-private partnership scheme in the U.S., and was a good example to show how PPP highways, or toll roads run by the private sector, were introduced in the U.S., where construction and operation of highways had been financed by public funds, i.e., dedicated gasoline taxes, motor vehicle registration fees, and direct federal aid. This subsection introduces two of the highways procured according to the AB680, State Route 91 (SR91) Express Lane project and Santa Ana Viaduct Express, State Route 57 (SR57) project. In actuality, SR57 project did not proceed further due to the Orange County bankruptcy, which caused the failure of a $25 million required funding to complete the environmental process on this project; however, the case still gives some insights for the framework of the Japanese PFI.

(1) AB680

Outline of AB680

With the difficulties to raise taxes in the state and tremendous needs to increase the capacity and to maintain the quality of highways and roads across the state, AB680 was introduced to stimulate the private sector's investment in one of the public infrastructure projects. The bill allows the ***California Department of Transportation (Caltrans)*** to award up to four highway projects franchises to private developers as demonstration projects, in which ownership should be transferred to Caltrans upon completion of the construction. Once selected, the private franchisee had exclusive rights to design, build,

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[31] 407 International Inc.: "News Release," *Website*, www.407etr.com

[32] Much information in this subsection is cited from Gomez-Ibanez and Meyer (1991): "Private Toll Roads in the United States, The Early Experience of Virginia and California," *Harvard University Report*; *Public Works Financing*, Vol. 91, December 1995; and *Public Works Financing*, Vol. 65, July/August 1993

finance, and operate the toll roads, collect tolls to repay the project debt, and earn a reasonable return on investment. Franchise agreements for all four were signed in January 1991. These projects were the following: Mid-State Toll Road northeast of San Francisco, SR125/San Diego Tollway, SR91 Express Lanes, and Santa Ana Viaduct Express (SR57)

To balance between filling public requirements and interesting the private developers, the bill had following features:

(a) Design and construction of the highways must comply with state environmental regulations and Caltrans standards.

(b) Out of four possibly awarded projects, at least one must be selected from Northern California and one from Southern California.

(c) Each of the demonstration projects must be a supplement of existing transportation services.

(d) Each of the demonstration projects must be financially self-standing.

(e) Excess toll revenues must be used to repay the project's debt or paid into a State Highway Account.

Project Selection Process of Caltrans

Immediately after the legislation of AB680, Caltrans issued Requests for Qualifications (RFQs), mailed them to more than 500 private firms, public agencies, and individuals, and then pre-qualified 10 groups based on the criteria shown in **Table 4-14**.

Table 4-14 Evaluation Criteria for Pre-Qualification of Caltrans Projects

Evaluation Criteria	Weight
Experience of the principal organization and consortium members	30 %
Record of financial strength to commit to a major transportation facility	30 %
Ability to work cooperatively with a broad range of governmental agencies and the public	20 %
Individual qualifications of key project team personnel	10 %
Organizational and management approach for project company or consortium	5 %
Familiarity and experience with automated traffic operations, Automatic Vehicle Identification (AVI) and Electronic Toll Collection systems	5 %

Source: Gomez-Ibanez and Meyer (1991)

Caltrans, in the next stage, requested each pre-qualified consortium for Conceptual Proposals. To minimize the state expenditure for the selection of the projects, Caltrans gave the consortia the opportunity to choose a transportation project. The final evaluation

criteria were established as **Table 4-15**. Identifying the project and preparing the proposal cost each consortia $1 million or more. The leading members of the consortia financed the development of the proposal in most cases.

Table 4-15 Evaluation Criteria for the Final Selection of Caltrans Projects

Evaluation Criteria	Points
Transportation service provided as a result of the proposal	20
Degree to which proposal encourages economic prosperity and makes overall good business sense	10
Degree of local support for proposal	15
Relative ease of proposal implementation	15
Relative experience and expertise of the proposal sponsors and their support team on similar projects	15
Degree to which the proposal supports the State's environment quality and energy conservation goals	10
Degree to which non toll revenues support proposal costs	5
Degree of technical innovation associated with the proposal	10
Degree of proposal's support for achieving the civil rights objectives of the State regarding the utilization of Minority and Women Business Enterprise	10

Source: Gomez-Ibanez and Meyer (1991)

Franchise negotiations followed the selection. After the intensive negotiation period, the winners completed the environmental review process and the final design and right-of-way acquisition for their projects.

(2) SR91 Express Lane Project

1) Project Outline

The SR91 freeway had experienced phenomenal traffic growth since it opened in 1968. SR91 passed through the Santa Ana Canyon and serves as the primary east-west link between the coastal and inland areas in southern California. SR91's traffic increased at an average annual rate of 8 percent throughout the 1980s, growing from 91,000 vehicles in 1980 to 188,000 in 1989. As AB680 passed, the CRSS Commercial Group began to form its development team to evaluate alternatives to relieve SR91's congestion.

The ***California Private Transportation Company (CPTC)***, a subsidiary of the CRSS Commercial Group, which was a large design and construction management firm, proposed the construction of four lanes in the median of the SR91 freeway for 10 miles

between the SR55 freeway near Anaheim in Orange County and the border with Riverside County. **Table 4-16** outlines the SR91 project.

Table 4-16 Outline of the SR91 Project

Location	California, Los Angels County through Orange County to Riverside County
Authority Concerned	California Department of Transportation (Caltrans)
Structure	Roads in mountainous area, in the median of the existing 8 lane east-west inter-state highway
Scale	10 miles, 4 lanes
Project Company	California Private Transportation Company (CPTC)
Design Speed	65 mph
Delivery System	Design-Build-Finance-Operate (DBFO)
Construction Period	(Contract) January 1991, (Open) December, 1995
Concession Period	35 years
Total Project Cost	$126 million ($88 million for construction)
Tolls for Cars	$0.25 -$2.50 (Congestion Pricing), Free for HOV3 (high occupancy vehicle); Cars with a transponder only

2) Project Structure

Organizational structure of the project is depicted in **Figure 4-12**. Once Caltrans gave the project company (CPTC) necessary permissions and approvals, CPTC was responsible for all of financing, design, construction, operation, and toll collection. Kiewit and Cofiroute had the CM (construction management) contracts.

The selected developer, CPTC, was a limited partnership between the following private companies[33]:

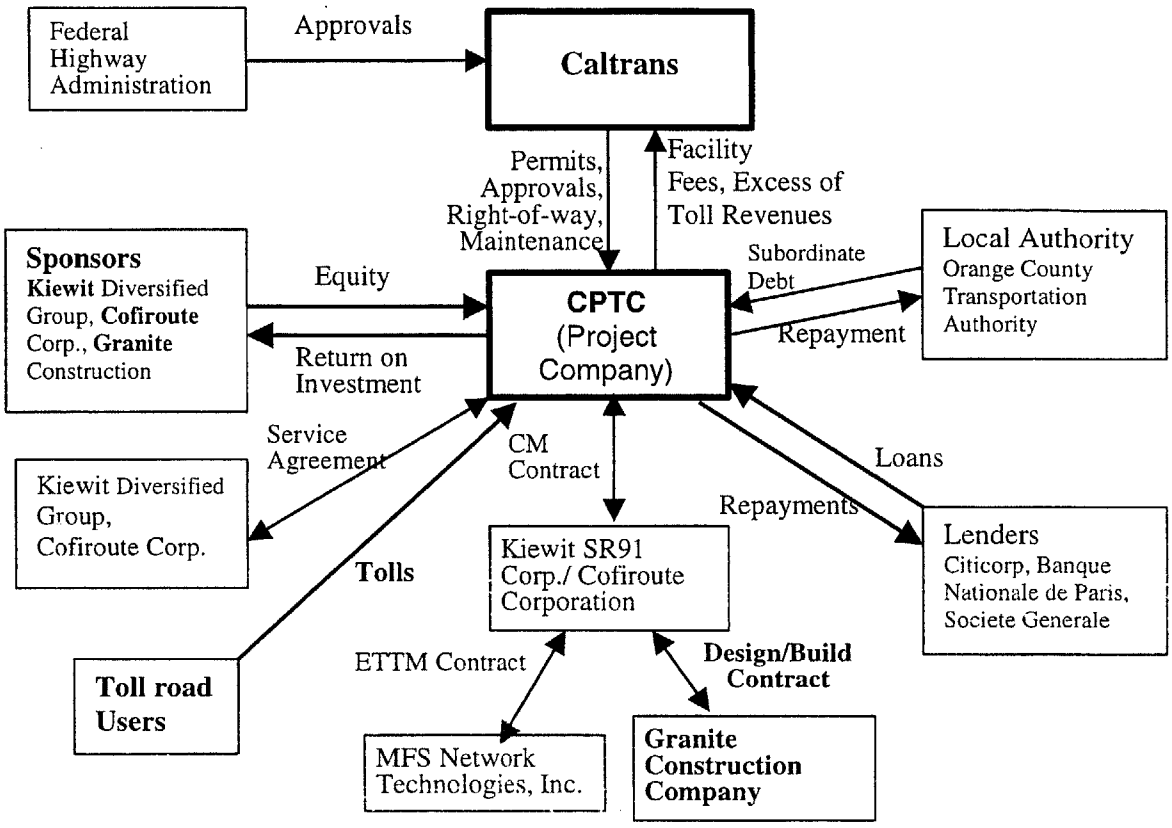
Kiewit Diversified Group was the major investor in CPTC and provided financial services for the project as well as construction management.

Cofiroute Corporation was the California subsidiary of Cofiroute, the world's largest private toll road operator, provided assistance and advice in the areas of operations, electronic toll collection, and traffic management for the SR91 project.

Granite Construction Inc., a large transportation contractor, was the primary civil works construction contractor for the project. A 25% limited equity partner in CPTC and the holder of the $56.9 million, 29-month construction contract.

[33] *CRSS Commercial Group*, a large and diversified engineering, design and construction services firm, was the original, sole company of this consortium.

MFS Communications Company Inc. (MFS) provided Automatic Vehicle Identification tolling equipment for the project. MFS was a subsidiary of Kiewit.



Source: *Public Works Financing*, Vol. 65

Figure 4-12 Project Structure of SR91

3) Financing Scheme

$126 million project cost was funded as shown in **Table 4-17**. 85% of the total project cost was from taxable debt markets. Both the bank loans and the institutional debt carried "favorable" rates because of the quality of the project and the long gestation period, which gave the lenders enough time to understand the risks.

CPTC was free to set toll rates, but the maximum return rate the project company might earn was set in the agreement. The maximum allowable rates of return on investment included two elements: a basic rate of return plus some incentive returns if the project achieved certain public objectives, such as increasing vehicle occupancy or reducing accident rates. Any excess over the maximum allowed returns would be used to retire project debt early or transferred to the state's highway account, as the AB680 legislation

required. The base return rate was 17% and the incentive return rate was 12% for the SR91 project. The incentive return should be shared equally with Caltrans, and CPTC's portion should be shared equally with Orange and Riverside Counties.[34]

Exclusivity is guaranteed to the developer, that is, no similar projects would be permitted within an "Absolute Protection Zone."

Table 4-17 Sources to Fund the SR91 Project

Source	$ millions
Funded Equity from Sponsors	19
Senior Debt: 14-year term loans from Citicorp, Banque Nationale de Paris and Societe Generale	65
Senior Debt: 25.5-year institutional debt underwritten by Kiewit Diversified Group	35
Subordinated Debt: 8.5-year term, 3-year post-completion subordinated loan at 9% from Orange County Transportation Agency	7
Total	**126**

Source: *Public Works Financing*, Vol. 65

4) Major Risk Profiles and Allocation

Major risk profiles and allocation of the SR91 project are shown in **Table 4-18**.

[34] 50 % of available cash flow could be retained by CPTC as incentive return and remaining 50 % to be paid to Caltrans as variable franchise fee whenever Base NPV > 0 and Total NPV < 0. When Total NPV > 0, i.e., when available cash flows excessed the permissible Return on Investment, the excess toll revenues must be paid into a State Highway Account.

Table 4-18 Risk Profiles and Allocation of the SR91 Project

Risk Type	Description	Cal-trans	CPTC
Pre-construction Risk	CPTC was responsible for securing the necessary environmental and land use permits, with no compensation if it was unsuccessful.	△	○
Completion Risk	The completion risk was minor. As the project was constructed between the existing lanes, the site condition was apparent. One impediment to the completion was the necessity to handle heavy traffic flows. Acquisition was not a problem because the use of the median of SR91 was an advantage of CPTC.[35] Granite Construction Company ultimately assumed the risk.		○
Market Risk (Demand Risk)	Traffic demand risk was completely assumed by the project companies, but it was in part mitigated with Non-compete Zones Clause, which refrained Caltrans from building competitive transportation facility within ten miles of the proposed project.		○
Operation Risk	Caltrans would assume the normal tort liability for accidents and fatalities associated with a highway owned by the state and designed to state standards.		○
Force Majeure	Force majeure risk was also assumed by CPTC, even though the public sector assumed the main responsibility for the risk in most of the other PPP project cases.		○
Political Risk	Caltrans would compensate CPTC if the state legislature, a state agency, or the state's voters passed a law or regulation that substantially reduced the value of the developer's right under the franchise agreement. Caltrans could only promise to make its "best efforts" to prevent this risk.	○	△
Financial Risk	CPTC wais obviously responsible for the financial risk. As one measure to mitigate the risk for CPTC, Caltrans gave the project companies the right to lease state-owned land within the right-of-way or the air space above it for the development of service stations or other projects for up to 99 years.		○

5) MCF's Roles

CRSS Commercial Group was the sole, original consortium of CPTC, and it evaluated over 75 projects before selecting the 91 Express Lanes. During the process, CPTC had gradually put stress on the relative ease of the implementation of the project, rather than the potential profitability with larger uncertainties. Therefore, in terms of the innovative thoughts to overcome the complexity of a project, this project required the MCFs less than the other seven competitive projects, or more potential projects, although the workload for the selection of the project was, of course, huge.

[35] In the criterion of 'Relative ease of proposal implementation,' one of the eight evaluation criteria for the final selection, CPTC's proposal received exceptional appraisal.

In SR91 case, Kiewit, which had the construction management function, did not participate in the project as a contractor, but as the main investor and a construction manager. Granite was the main contractor, shared 25% responsibility as a sponsor by equity holding, and took part in the $88 million construction. Because the equity portion of Granite was assumingly some $5 million, the equity investment would be within Granite's profit margin from the construction contract.

(3) SR57, The Santa Ana Viaduct Express (SAVE) Project

1) Project Outline

Although the project was not realized, the proposed outline of the project is outlined in **Table 4-19**. As the top ranked proposal among all the proposals, The Santa Ana Viaduct Express project was selected by Caltrans as one of the four demonstration projects under the AB680. This project was aimed to add another alternative to the route from the Disneyland/Anaheim Stadium area to John Wayne Airport, perhaps the most congested set of roadways in all of Southern California.

Table 4-19 Outline of the SR57 Project

Location	Alternative to the route from the Disneyland/Anaheim Stadium area to John Wayne Airport, California
Authority Concerned	California Department of Transportation (Caltrans)
Scale	11.7 miles, 4 lanes
Structure	8.3-mile viaduct in an existing channel. The rest is along other freeways.
Project Company	The Perot Group
Design Speed	
Delivery System	Design-Build-Finance-Operate (DBFO)
Concession Period	35 years
Total Project Cost	$702 million (later raised to $750 million)
Tolls for Cars	$0.25 -$5.00 for AVI charge and $3.00 -$5.00 for Cash charge (Congestion Pricing)

A characteristic feature of the project was the utilization of the existing Santa Ana River channel owned by US Army Corps of Engineers as part of the flood control system. This 8.3-mile utilization, along with 3.4 miles of the rest being located along I-405 or Route 73 in the existing right of way, significantly reduced the burden of right of way

requirements and costs of the 11.7-mile project. **Figure 4-13** shows the typical section of the channel utilization.

The project included exclusive toll collection lanes as well as manual lanes, special rates for high occupancy vehicles, and used congestion pricing concepts ($5 per car during the rush hours and $1 per car in the off peak). The estimated total construction cost was over $700 million, which was much smaller than previous studies, thanks to using an innovative bridge construction technique.

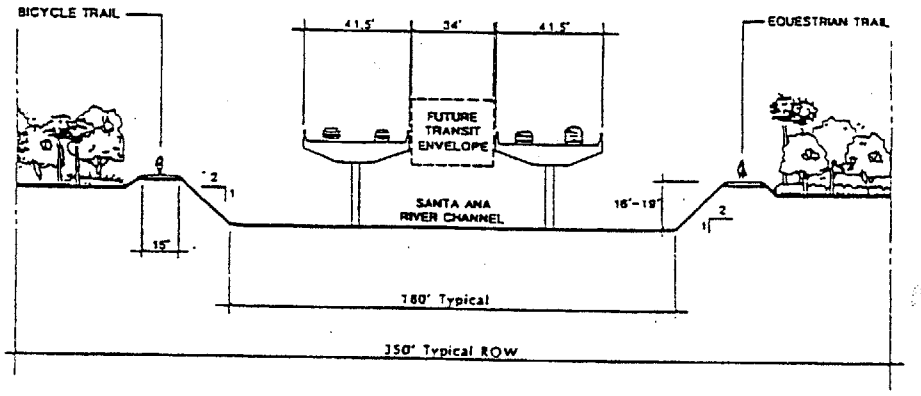


Figure 4-13 Typical Section of the Santa Ana Viaduct Express Project (SR57)
Source: National Toll Road Corporation

2) Project Structure

Since Caltrans tried to be consistent in the framework of the concession agreements with four selected consortia, the basic project structure was intended to be the same as that of the SR91 project, which is described in **Figure 4-12.**

The selected consortium comprised the following private companies. The consortium spent four months evaluating over 40 alternative projects with the cost of $1.5 million.

The Perot Group, a large land developer and the main investor

Greiner Engineering Inc., the engineering consultant

Keiwit Pacific Company, the construction contractor except toll plaza and communication

Amtech Systems Corporation, the electronic toll equipment supplier

The First Boston Corporation, the investment bank

Traffic Consultants Inc., the consultant engaged in the planning and development of transportation infrastructure

URS/Coverdale & Colpitts, the consulting engineers to project traffic volumes

Nossaman, Gunther, Knox & Elliot, the law firm

Putnam, Hayes and Bartlett Inc., the economic and management consulting firm

3) Financing Scheme

Within some $700 million total cost for the project, costs for the pre-construction phase, estimated some $47 million, were mainly funded by consortium members as the equity contribution. Orange County also provided subsidy of $225,000 to this project in the pre-construction phase.

Construction phase costs were first made by equity, but mostly by debt, though the figures are not known. The consortium made every effort to minimize interest costs by taking advantage of the design-build scheme, which included the merit of close interface between design and construction teams and fast track construction.

The take-out financing would be composed of, from senior tiers, revenue bonds, the replacement and renewals fund, the general reserve fund, subordinated debts, and contributions of equity from the consortium. The replacement and renewals fund and the general reserve fund were used also as a mitigation of the financing risk for Caltrans and financiers. The highest base rate of return among the four AB680 projects, 20.25%, was allowed by Caltrans, reflecting the riskiness of the project, in particular the uncertainty in toll revenues. Also, a series of Area Development Projects and Commercial Property Developments were permitted by AB680, so supplemental revenues could be raised.

4) Risk Profiles and Allocation

Risk profiles were quite different from the SR91 project in pre-construction environmental issues, completion risk (cost overrun), and traffic volume uncertainty. The viaduct design might not be enough to eliminate neighborhood opposition to the SR57 project. The most likely concern was the height and visual impact of the viaduct. The viaduct would be 30 or more feet above the top of the embankment in order to clear the bridges that cross the Santa Ana River. Construction cost was also quite uncertain because of the adoption of an unproven technique. The environmental issue was the actual cause of the non-realization of the project.

Risk allocation of the SR57 project agreed between Caltrans and the Perot Group was basically same as that of the SR91 project, which is shown in **Table 4-18**.

5) MCF's Roles

The consortium was considering innovative methods for building the viaducts that might significantly reduce construction costs. The estimated total construction cost was over $700 million, which was much smaller than previous studies, thanks to using the innovative technique. Actually, when Caltrans first studied the same alignment in late 1960s, the option was so much more costly than others that it was not given very serious consideration at the time. Moreover, two other consortia considering the same project thought the construction cost would be too high to be repaid by toll revenues alone. Therefore, if the project were successful, the magnitude of the MCF that developed the innovative technique would have been huge.

4.2.6. Sydney Harbour Tunnel in Australia[36]

The Sydney Harbour Tunnel project is an Australian BOT project initiated by two construction companies, Australian and Japanese, and has been completed successfully. This project suggests various issues with respect to the roles of construction firms, project finance structuring, and so on.

1) Project Outline

The Sydney Harbour Tunnel was constructed to relieve the serious congestion of the Sydney Harbour Bridge. The Bridge, used for both railroad and road with 8-lane width, opened in 1932 and have served as the only crossing between north and south sides of the Sydney Bay, large residential districts and political and economic center (the Central Business District), respectively. Since 1970s, traffic congestion had gradually become a chronic problem. While the Government of New South Wales (NSW) requested for proposals for a second crossing, none of the responses was feasible due to the difficulties of the right-of-way acquisition, environmental issues, or construction costs.

In February 1986, a team of Transfield, an Australian construction firm, Kumagai Gumi, a Japanese construction firm, and a domestic consultant together examined the

[36] Most information in this subsection is cited from Arioka, Masaki (1995): "The Construction of the Sydney Harbour Tunnel by BOT," *Kaikyo Oudan Vol.3*

project and proposed a BOT plan to the State. The Government of NSW then authorized the preparation of a detailed feasibility study by the Transfield Kumagai Joint Venture to further develop the proposal. The ***Sydney Harbour Tunnel Company (SHTC)***, formed by the Joint Venture to design, construct, finance, operate, and maintain the tunnel, entered into the agreement with the Government in June 1987, and the project commenced. The proposal resolved the problems such as environmental and landscape concerns, land acquisitions, and the construction cost as well as matched the State's 20-year road system development plan. **Table 4-20** outlines the project.

Table 4-20 Outline of the Sydney Harbour Tunnel Project

Location	Between north and south sides of the Sydney Bay, NSW, Australia
Authority Concerned	Roads and Traffic Authority (RTA), NSW, Australia
Scale	2,280 meters, 4 lanes
Structure	Main Tunnel: 8 reinforced concrete immersed tube units, each 120 m long (960 m), Maximum Depth: 27 meters below mean sea level (base of tube) Land Tunnel: 870 meters on North shore and 390 meters on South shore Ventilation Building: 60 meters long, Utilization of a pylon (90 m above the ground) of the Sydney Harbour Bridge
Project Company	Sydney Harbour Tunnel Company (SHTC), sponsored by Transfield (50%) and Kumagai Gumi (50%)
Design Speed	70 km/h
Delivery System	BOT
Construction Period	June 29, 1987 – August 31, 1992 (Approx. 5 years)
Concession Period	30 years (September 1, 1992 – August 31, 2022)
Design Life	100 years
Total Project Cost	A$ 750 million: A$ 550 million for investigation, design, and construction, and A$ 200 million for finance cost during construction[37]
Tolls for Cars	A$1 (A$0.50/one-way equivalent)

[37] For the convenience purpose, US$1= A$2.06 as of March 31, 2001.

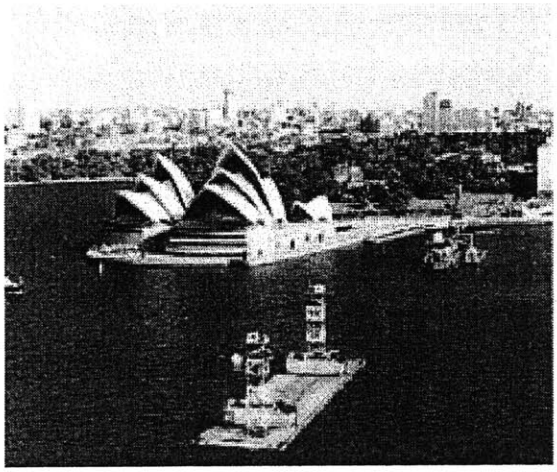


Figure 4-14 Towing a Immersed Tube

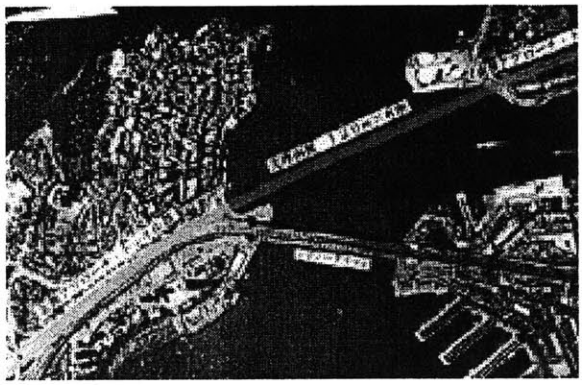


Figure 4-15 Route of the Tunnel (Upper Line)

Source: www.kumagaigumi.co.jp/product/know020

2) Project Structure

The project structure of the Sydney Harbour Tunnel project is shown in **Figure 4-16**.As in most BOT projects, the private project company, SHTC, was given the concession rights, and it designed and built the tunnel. Two MCFs, Transfield and Kumagai Gumi, are the equity holders of the Tunnel Holding Company. After the 30-year concession period, tunnel ownership is transferred to the Government of NSW free of charge. Upon the transfer, the government will have an asset worth subsidizing the project.

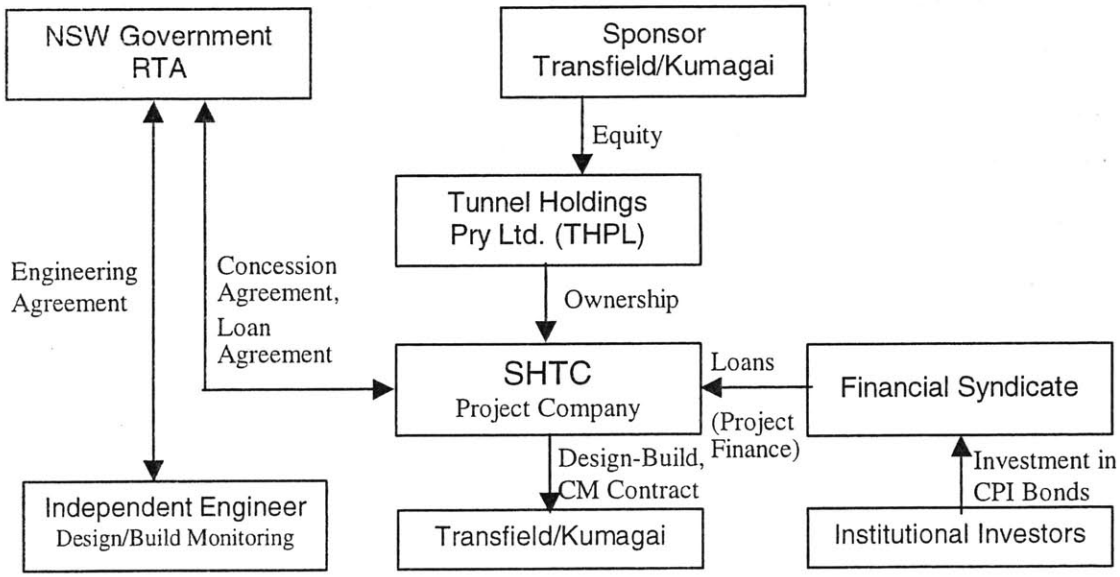


Figure 4-16 Project Structure of the Sydney Harbour Tunnel Project
(Source: Kumagai Gumi)

3) Financing Scheme

Sources of funds of the Sydney Harbour Tunnel project are, as **Table 4-21** shows, non-interest bearing debt from the government, bonds issued by the SHTC, and funds from sponsors.

Table 4-21 Sources of Funds of the Sydney Harbour Tunnel Project

Sources of Fund		
Non-interest Debt from the Government	A$ 223 million	29.7%
Bonds issued by SHTC	A$ 463 million	61.7%
Other Loans (35 year term)	A$ 57 million	7.6%
Equity from Sponsors	A$ 7 million	0.9%
Total	A$ 750 million	100%

The non-interest bearing debt from the NSW Government is a subsidy funded by raising the tolls of the Harbour Bridge from A$0.20 to A$1. The bonds issued by the SHTC have adjustable rates that are tied to the CPI, with 30-year maturity. To redeem the bonds, toll rates are also related to the CPI. The equity, tolls from the tunnel, and the government subsidy from the Bridge tolls are used for bond repayment and tunnel operation.

Based on the conservative estimation of the traffic volume, the government gave SHTC a guaranteed level of the revenue from passengers. In return, the government retained the right to set the toll rates and to receive any surplus toll revenue. The construction cost was guaranteed by the contract with the construction Joint Venture on the turnkey basis.

4) Risk Profiles and Allocation

Major risk profiles and allocation are described in **Table 4-22**. Compared to other BOT-kind projects, the government assumes more substantial risks, in particular, of the demand (traffic volume) risk.

Table 4-22 Risk Profiles and Allocation of the Sydney Harbour Tunnel Project

Risk Type	Description	Gov't	SHTC
Pre-construction Risk	Transfield and Kumagai jointly made significant efforts to investigate the project with no guarantee that the project would be realized.	△	○
Completion Risk	There are numerous restrictions to be applied to various construction stages as well as uncertainties about innovative construction methods and ground conditions. Completion risks, both cost and time overruns, are thus quite large. SHTC assumed the risk by means of transferring to the construction JV with a full-turnkey lump-sum contract.		○
Market Risk (Demand Risk)	The government conservatively forecasted future traffic volumes using a consultant. Although there was a growing demand for traffic, the demand risk of a long, 30-year forecast was substantial in the project. The Government guaranteed the revenue from tolls, both from the Bridge and from the Tunnel, and the revenue wais used for bond repayment and the tunnel operation. Therefore, either surplus or deficient revenues would be attributed to the Government.	○	△
Operation Risk	The project company was responsible for the operation of the Tunnel, which included collecting tolls, operating and maintaining the facilities, and responding to emergencies, within the agreed operation budget. The mutual agreement ensured the risk assumption (The project company would not be paid back for the investment without efficient operation and maintenance). The Government monitored the operation.		○
Force Majeure	The Government basically assumed force majeure risk.	○	△
Political Risk	The Government basically assumed this risk.	○	△
Financial Risk	The financial institutions issued the bonds, which were the main source of the project funds and whose rates were related to the CPI, and were responsible for the redemption. Creditworthiness of the project, or the project structure, was the crucial concern for the syndicate. The project company contributed an equity portion, even though it was relatively small. Therefore, this risk was mostly allocated to the financial institutions in actuality.		○

5) MCFs' Roles

The construction Joint Venture not only exercised their potential technological expertise for the complicated project based on their experiences but also developed innovative construction methods and soft tools such as financial schemes and environmental solutions. Without their contributions, this project could not been completed. They played a number of valuable roles in the planning, design, and construction stages:

(a) Identifying the route of the tunnel with such restrictions that 1) there was no need to acquire private property, 2) influences to the landscape should be minimized during

and after the construction, and 3) the route should be identical with the road plan for the 21st century,

(b) Putting ventilation facilities underground and restoring the surface to its present state,

(c) Solving two propositions: preventing air pollution caused by the exhaust and protecting the scenery, by utilizing the 90m-high hollow pylon of the Harbour Bridge as the ventilation tower,

(d) Establishing an innovative means to tow the immersed tunnel tubes 70 kilometers in the outer sea so that the environment of the resident district would be protected, and

(e) Preserving the scenery of the forecourt of the Opera House by working underground.

4.2.7. DBFO roads in the U.K. (British PFI)[38]

The British PFI was the model for the Japanese PFI. Thus studying road projects developed by the British PFI helps to establish a framework for the Japanese PFI for the toll road project. This subsection examines the first eight "DBFO roads" procured by the British PFI collectively.

1) Project Outline

The Eight DBFO Roads

After the *Department of Transport* announced that the private sector would be invited to tender for DBFO roads in November 1992, contracts for the eight DBFO projects were awarded with a combined capital value approaching £600 million to private consortia as PFI projects by the ***Highways Agency***, an executive agency of the Department, between January and October 1996.[39] The list and distribution of the eight projects are shown in **Table 4-23** and **Figure 4-17**. Because the DBFO roads adopt "shadow tolls" as described shortly, there is no significant operational feature for the road users to distinguish a DBFO road from the rest of the trunk road network.

Objectives of the DBFO Road Projects

The Highway Agency procured the eight DBFO roads as PFI projects with following objectives:

[38] Most information in this subsection is cited from Highway Agency, U.K. (1997): DBFO – Value in roads

[39] For the convenience purpose, US$1 = £0.7061= ¥ 126.25 = EUR1.1494 as of March 31, 2001.

(a) To ensure that the road is designed, maintained and operated safely so as to minimize any adverse impact on the environment and maximize benefit to road users;

(b) To transfer the appropriate level of risk to the private sector;

(c) To promote innovation, not only in technical and operational matters, but also in financial and commercial arrangements;

(d) To foster the development of a private sector road-operating industry in the U.K.; and

(e) To minimize the financial contribution required from the public sector.

Transferring responsibilities for design, construction, finance, and operation of a road and allocating appropriate risks to the private sector lead to efficient service and a lower whole-life cost for the Agency. One objective of DBFO procurement was to minimize claims. According to a National Audit Office report, claims contributed to a 28 % average increase of the construction from the tender price, attributing to the separate contracts (design, construction, and operation). The first eight DBFO road projects achieved 15% average cost savings compared with the PSC (public sector comparator). (DBFO – Value in roads)

Table 4-23 List of DBFO Road Projects (Source: DBFO – Value in roads)

	Miles	Estimate of capital value (£m)
Tranche 1		
A69 Newcastle to Carlisle	52	9.4
M1-A1 Motorway Link, Leeds	18	214
A1(M) Alconbury to Peterborough	13	128
A417/A419 Swindon to Gloucester	32	49
Tranche 1A		
A50/A564 Stoke to Derby Link	35	20.6
A30/A35 Exeter to Bere Regis	63	75.7
M40 Junctions 1-15	76	37.1
A168/A19 Dishforth to Tyne Tunnel	73	29.4

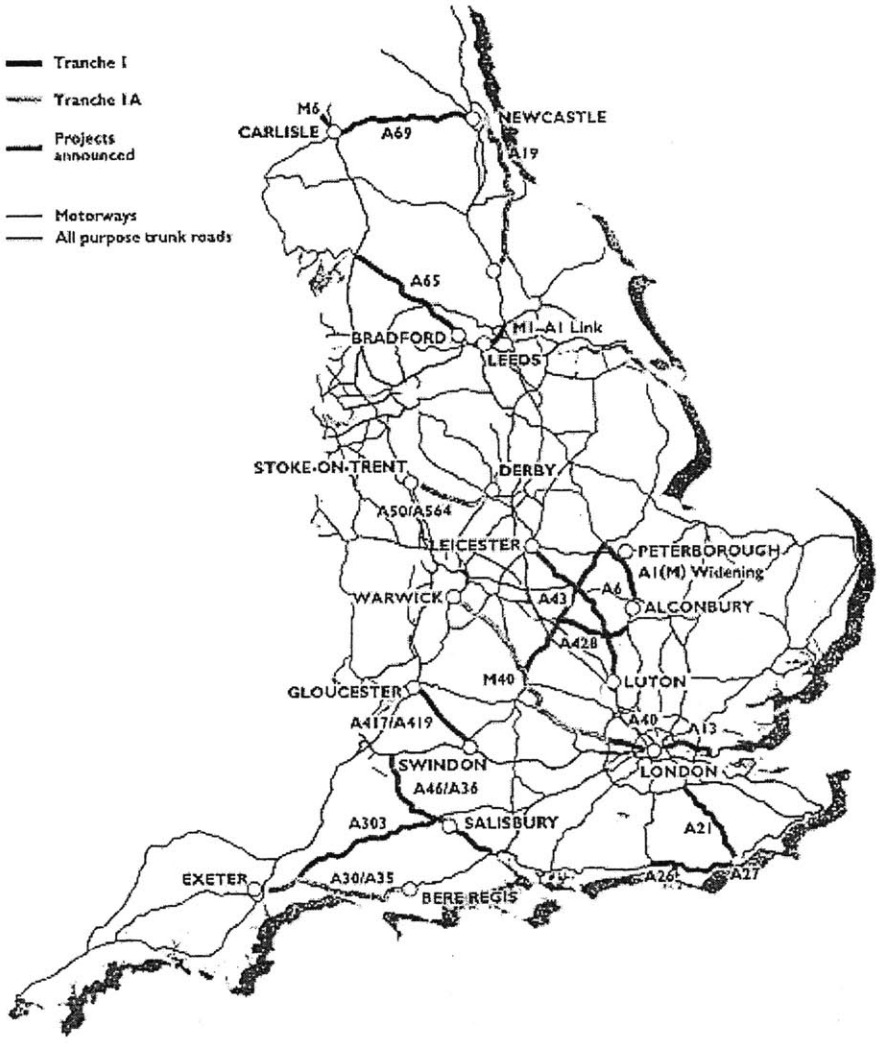


Figure 1.1

Figure 4-17 Distribution of DBFO Road Projects (Source: DBFO – Value in roads)

Although the eight projects include both improvement to existing roads and new construction and therefore differ in the treatment of certain provisions of the contract, descriptions in this subsection are generally common to all the projects. For example, the DBFO contract periods of the projects are all for 30 years from commencement dates, with some possible adjustments, partly to encourage financial innovation of exceeding conventional 10 to 15-year debt terms.

Project Company Selection Procedure

In order to help ensure that bidders make good efforts to win a contract, the Agency requested pre-qualifications. The Agency took the view that four was the optimum number

of bidders to promote healthy competition. The criteria for evaluation were technical, financial, and economic track-record of the bidding consortium on similar infrastructure projects involving construction, maintenance, operation, and financing responsibilities.

Once the approved bidders were selected, the Agency issued the tender documents and asked the bidders to return their bids by a set date. After the clarification of each bid, the initial negotiation took place, focusing on how risks were allocated and whether good value for money was offered. Shortlisted bidders were selected, and after the second round of negotiation, they were asked to return their Best and Final Offer (BAFO), which the Agency evaluated to select the provisional preferred bidder (PPB). Following final, more detailed, and lengthy negotiations, contract would be completed.

2) Project Structure

The typical contractual structure of DBFO road projects is depicted in **Figure 4-18**. Shareholders in the figure are usually either an MCF, an engineering firm, or an investment firm that comprise the project company (shown as "DBFO Co").

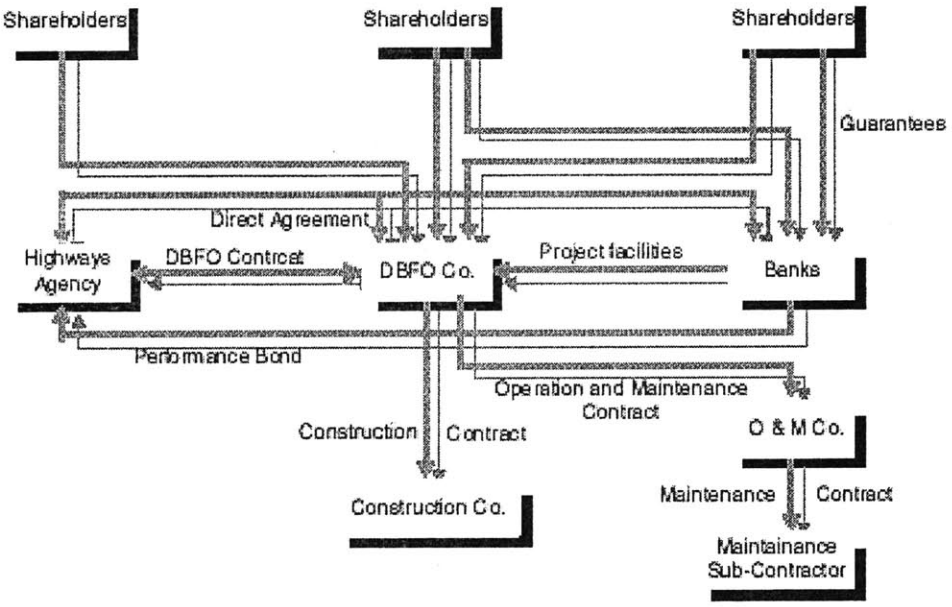


Figure 4-18 Typical Contractual Structure of DBFO Road Projects (Source: DBFO – Value in roads)

3) Financing Scheme

Equity and Debt Financing

The eight DBFO roads were funded by both equity and debt, though the ratio varied project-to-project. The consortia, or the project companies, were the sole contributors of

the equity to date. Some use so-called "quasi-equity" in the form of subordinated debt in order to seek a less expensive source of financing and the third party investors. Equity contributions from third parties and the transferability of equity are the emerging issues of the British PFI.

Debt financing was raised through commercial bank loans, funding from the European Investment Bank (EIB), and the proceeds of bond issues. The debt usually had a repayment period of 15 to 20 years and margins of between 120 and 140 basis points, with limited recourse. EIB is non-profit making and therefore can offer smaller margin than commercial banks, but it does not take risks in the construction stage. Hence, in practice, some form of guarantee was required for debt financing during the construction phase. For instance, a £165 million secured bond was issued to fund the construction costs of two DBFO road projects (the A1 (M) and A417/419) both awarded to RMG, a project company. Since the bond was supported by an unconditional guarantee, it received an AAA rating, and the coupon on the bond was relatively small 9.18%.

Shadow Tolls

One of the distinguishing characteristics of the British DBFO roads was the payment mechanism for the provision of the road service. Instead of real tolls, paid by the road users, "shadow tolls" were paid to the project company by the Agency based on the number and type of vehicles using the road.

Bidders were asked to bid the parameters of traffic levels for a maximum of four bands, with the top band set a zero toll to ensure that the maximum liability of the Agency was capped. Typical bidders set the lowest band with a cautious view such that they would cover the debt service (but not a return on equity). Shadow toll payments generally increased over time according to an indexation formula.

For the project of the improvement of an existing road, 80% of the full level of traffic payment was made representing the availability once the Permit to Use was issued. The toll payments stepped down, in most cases, when the third party debt was fully repaid. Revenue in excess of operating and maintenance costs would be used to provide a return on equity. There were two other adjustments to payments: safety performance payments as a bonus and lane closure charges as penalties.

National Audit Office's Report

The National Audit Office (NAO) continuously examined the efficiency of PFI projects in the U.K. For the first four DBFO projects (Tranche 1), introduced in the foregoing, the NAO issued a report, "The Private Finance Initiative: The First Four Design, Build, Finance and Operate Roads Contracts." In the report, the NAO stated that the projects had produced better value for money with a net financial saving of £99 million (13 %) even though this figure is less than the Agency's original estimate of £168 million. This reduction in savings was a result of the different discount rates used. The Highways Agency used a discount rate of 6 %, but the NAO raised the problem of the uncertainty and sensitivity of the rate and calculated by using an 8 % discount rate, which was recommended by the Treasury's published guide for financed projects.

4) Risk Profiles and Allocation

Under a British PFI contract, the private sector was generally assumed to take the following risks: construction and operational cost overruns, delay in delivery of service, design of the underlying asset, not delivering the agreed service, and changes of law. Changes of law included tax law changes, which imposed additional or increased costs on the operator. There are some other risks to be taken into account for DBFO road projects: traffic risk, protestor risk, and latent defect risk.

Traffic forecasting was one of the responsibilities private consortia had to take, and the demand risk was to be assumed by the project company. Although the Agency made its forecasts for each of the DBFO projects, they were kept confidential to encourage the bidders to make their own traffic growth projections.

Protestor risk, the increase in direct action to delay construction of new roads, and latent defect risk, structural problems on the road that could not be detected during pre-contract investigations, were responsibilities of the project company. Once the detailed design/construction phase took place, the project company best suited to managing these risks.

Table 4-24 summarizes the risk allocation agreed in the contracts of first four DBFO road projects.[40]

Table 4-24 Risk Profiles and Allocation of the DBFO Road Projects

Risk Type	Description	Public	Private
Pre-construction Risk	The public sector assumed all the risk in the development stage, while pre-qualified limited numbers of private consortia bore the risk in preparing for bids.	○	○
Completion Risk	After provided the "existing design," the private sector needed to develop their own design and built the facilities. The private sector was solely responsible for the detailed design and construction. Neither availability fees nor the shadow toll was paid to the private sector until the required services were available.		○
Market Risk (Demand Risk)	If the traffic volume was less than expected, the project company would earn the less revenue than expected and the public sector would pay a more expensive average toll rate to the company. If the traffic volume was more than expected, the public sector would need to pay more shadow tolls to the company but the company would earn the lower rate tolls with a ceiling.	○	○
Operation Risk	The private sector assumed the risk. Lane closure would reduce the revenues.		○
Force Majeure	The public sector basically assumed the force majeure risk. However, the definition of the force majeure was limited (e.g., abnormal weather conditions are excluded), and some unfavorable influences would be inevitable.	○	△
Political Risk	Risks to the changes of laws were borne by the private sector, even though the public sector was recommended, in a NAO report, to assume the political risk in general.	○	○
Financial Risk	The private sector, together with financial institutions and other investors, assumed the financial risk. The private sector transferred the risk in part through some insurance.		○

5) MCFs' Roles

To give bidders the opportunity to exercise their potential creativity, the Agency provided only the fundamental requirements for design, construction, operation, and maintenance of the project road (core requirements), together with the Agency's own design proposals (existing design), in the Invitation to Tender. As this scheme requires, MCFs' proactive roles were essential for a consortium to offer a good bid. In fact, every

[40] National Audit Office, U.K. (1998): The Private Finance Initiative: The First Four Design, Build, Finance and Operate Roads Contracts; and National Audit Office, U.K. (1999): Examining the Value for Money of Deals under the Private Finance Initiative

consortium running the DBFO project was led by a major construction or engineering firm, followed by an experienced operations firm.

However, the Agency expects still more demanding tasks of the private sector in the future projects. The Agency's stance is that, the private sector should be involved in the initial design of the road scheme and should assume some planning risks. The MCF's role would become more and more important when the consortium is more involved in the planning stage.

4.2.8. Kanamachi Co-generation System Project (Japanese PFI)[41]

Kanamachi Co-generation System project, installed in the Kanamachi Water Purification Plant, is a significant example of the pioneer PFI-type projects in Japan. This and the following subsections introduce practical experiences of the Japanese PFI.

1) Project Outline

In the Kanamachi Co-generation System project, the private undertaker installs, owns, and operates the co-generation system and provides the Bureau of Waterworks (BOW) of ***Tokyo Metropolitan Government (TMG)*** with electric power and steam, which TMG purchases. The electric power is used both in ordinary condition and in emergencies such as if the Tokyo Electric Power Company (TEPCO) stops power supply in the cases of earthquake. The steam is used for humidification of sludge in the drainage treatment facility and for heat drying the generated soils. **Table 4-25** shows other basic facts of the project.

[41] Much information in this subsection is cited from TMG, Bureau of Waterworks: "Kanamachi Water Purification Plant, Co-generation System, PFI Model Project," *Pamphlet*; and TMG, Bureau of Waterworks (1999): Kanamachi Water Purification Plant, Co-generation System, PFI Model Project, Request for Proposals.

Table 4-25 Outline of the Kanamachi Co-generation System Project

Location	Kanamachi Water Purification Plant, Kanamachi, Katsushika-ku, Tokyo, Japan
Authority Concerned	The Bureau of Waterworks (BOW), Tokyo Metropolitan Government (TMG)
Capacity of the Plant	7,000kW-cogeneration power plant, which will be capable of outputting 10,000kW in an emergency
Type of Project	Service Purchasing Type (The public sector purchases a service.) BOO (Build Own Operate)
Project Company	Kanamachi Water Purification Plant Energy Service Co.
Investing Company	IHI, Shimizu Corp., and Electric Power Development Corp. (EPDC)
Concession Period	1999.10 – 2030.10 (Operation from 2000.10, until dismantle)
Project Cost	¥25.3 billion, 20 year payment to the project company and TEPCO

Project Procedure

Project procedure until the selection of the private undertaker was shown in **Table 4-26**.

Table 4-26 Project Procedure of the Kanamachi Co-generation Plant Project

January 27, 1999	Distribution of the Tender Documents	Open to the public
February 15, 1999	Pre-bid Meeting on Site	100 firms attended.
March 29, 1999	Submission of Proposals	11 groups submitted.
April 21, 1999	Announcement of the Result of Evaluation Step 1	Passed were those groups that satisfy the criteria Bureau of Waterworks had determined. 5 out of 11 proposals passed
June 16, 1999	Request for 2nd Step Proposals	
July 15, 1999	Submission of Proposals	
July 23, 1999	Announcement of the Result of Evaluation Step 2	Passed was the group whose proposal showed the lowest cost for Bureau of Waterworks.

2) Project Structure

Ishikawajima-Harima Heavy Industries (IHI), Shimizu Corporation, and Electric Power Development Corporation (EPDC) established ***Kanamachi Water Purification Plant Energy Service Corporation (KESCO)***, an SPC (special purpose company) for this

project. KESCO and the TMG reached 20-year concession agreement for the co-generation service. **Figure 4-19** shows the structure of the project.

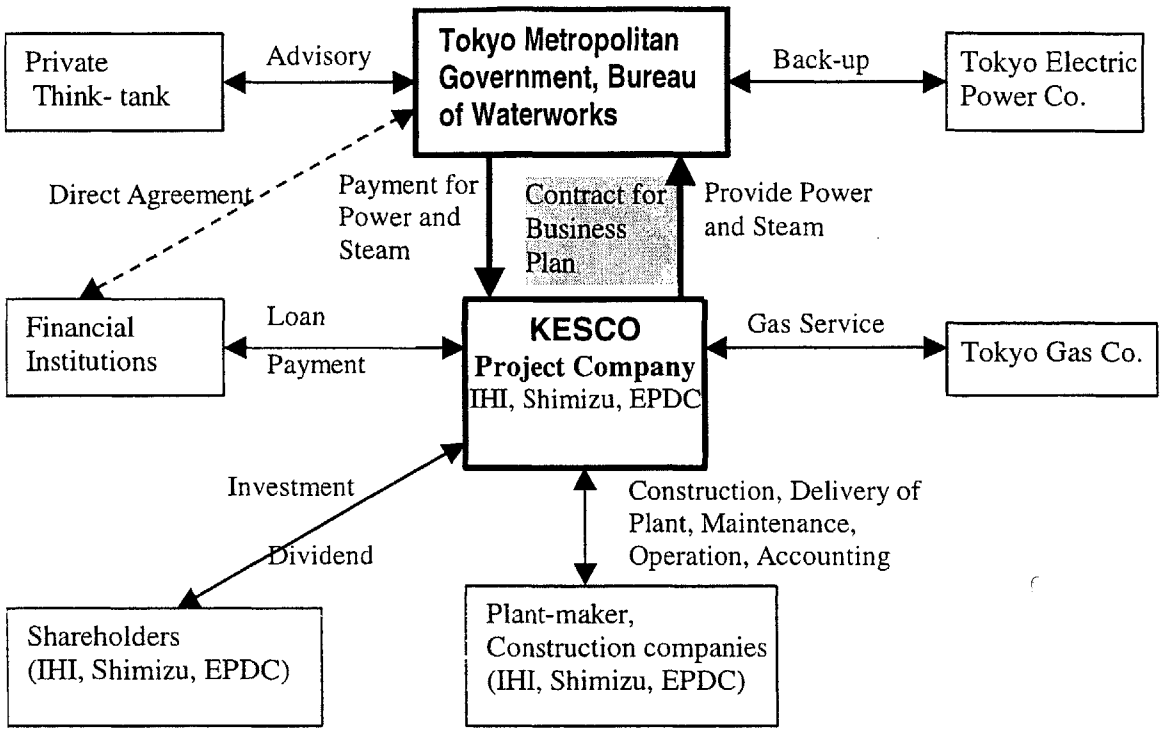


Figure 4-19 Project Structure for the Kanamachi Co-generation System Project (Source: IHI, Kesco)

4) Financing Scheme

"Project financing" is used to fund the project, that is, the lenders invested in the project itself rather than the sponsoring companies because the project structure is creditworthy enough for project financing. Total financing amounts to approximately ¥1.1 billion. Additionally a loan from New Energy and Industrial Technology Development Organization (NEDO) for FY2000 of approximately ¥411 million was paid as a subsidy from TMG. The loans are repaid by the service payments of TMG during the 30-year concession period. The equity contributed by the sponsors are ¥60 million in total, of which IHI provides 60%, and Shimizu and EDPC provides 20% each. The sponsors will raise the equity stake to ¥240 million in the future.[42]

5) Risk Profiles and Allocation

Risk profiles and allocation are shown in **Table 4-27**. In addition to the allocation described in the Table, KESCO utilizes an insurance broker and employs a total package of

[42] Ishikawajima-Harima Heavy Industries Co. Ltd. (IHI): *Website*, www.ihi.co.jp

insurance coverage such as fire, earthquake, completion, and penaltiesfor both the SPC and the EPC contractors.

Table 4-27 Risk Profiles and Allocation of the Kanamachi Project (Source: IHI, Kesco)

Risk Type	Description	TMG	KESCO
Pre-construction Risk	TMG assumes all the risk in the development stage, while KESCO bear the risk in preparing for bids.	○	○
Completion	KESCO needs to complete the project within the budget and time, meeting performance criteria. KESCO shall pay the penalty to TMG if the commencement delays, while TMG is responsible for the operation and availability of the pertinent facilities.		○
Fuel	Gas and water as fuel shall be provided. If gas or water supply stops, KESCO is indemnified for providing power and steam to TMG.	○	
Operation	The facility shall be operated stably, and power and steam shall be provided properly. If the system stops in an accident, KESCO shall pay the penalty.		○
Inflation	The fluctuation of prices during 20 year long period may cause cost increase. Electric power and steam prices are adjusted by the index formula that identifies costs such as fuel, personnel, and materials.	○	
Force Majeure	Force majeure such as earthquake and flood may cause damages of facilities or impossibility of the trade. KESCO shall keep supplying electric power on and after an earthquake of no more than 0.6G horizontally and 0.3G vertically. Otherwise, TMG is responsible for the risk with the deduction of ¥1 million.	○	△

6) MCFs' Roles

In this particular case, IHI should be assumed to be an MCF because this is a plant-engineering project. IHI, together with other participants, plays a significant role in the course of the PFI procurement in the following areas:

(a) Minimization of the project costs: Efficiency of the plant, Construction cost, Finance cost, Maintenance cost, Labor cost, Insurance cost,

(b) Technical proposal: Electric power supply plan, Steam supply plan, Curtailment of power supply from TEPCO,

(c) Earthquake-proof facilities with design horizontal seismic coefficient of no less than 0.6,

(d) Operation and management system of the plant, and

(e) Credibility of the plant and maintenance management system.

4.2.9. Kanagawa Hoken-Iryo-Fukushi Daigaku (Japanese PFI)

Kanagawa Hoken-Iryo-Fukushi Daigaku (***Kanagawa Prefectural College, KPC***) is procured concurrently with the development of the Japanese PFI scheme and becomes one of the PFI model projects.

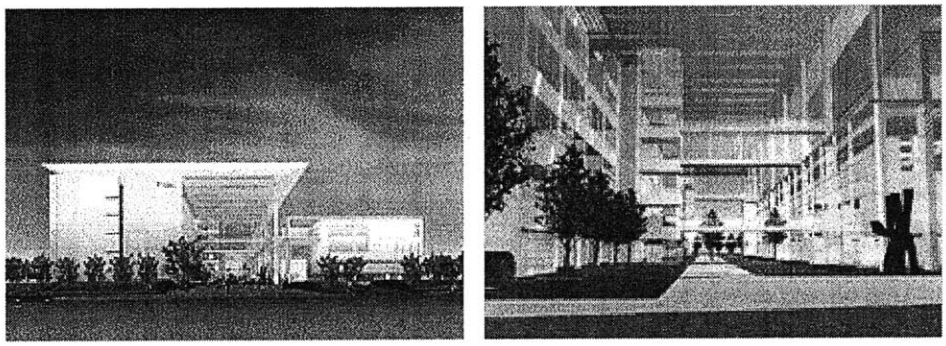


Figure 4-20 Images of the KPC Project (Source: www.obayashi.co.jp)

1) Project Outline

Kanagawa Prefecture has a unique procurement scheme: to pay a private undertaker for loans to design and construct public facilities. In the KPC project, to adapt the Japanese PFI scheme, the Prefecture includes operation and maintenance in the project scope. Upon the completion of the college, the Prefecture owns it and pays the operation fees to the private undertaker for a 30-year term. **Table 4-28** shows other basic facts about the KPC project.

Table 4-28 Outline of the Kanagawa Prefectural College (KPC) Project

Location	Yokosuka-city, Kanagawa Prefecture, Japan
Authority Concerned	Kanagawa Prefecture
Specifications	No more than 40,000m^2 total floor area, with administration offices, lecture rooms, experiment facilities, an auditorium, a library, a gymnasium, outside sport facilities
Type of Project	Installment Lease (Kanagawa-type PFI) BTO (Build-Transfer-Operate)
Project Company	"SPC PFI Kanagawa 1"
Investing Company	Obayashi Corporation
Contract Period	2000.6.3 – 2003.1 for Design and Construction 2003.4 – 2033.3 for Operation/Maintenance
Project Cost	Approx. 21.5 billion Yen (PV, NPV= $200 million)

Evaluations of Proposals[43]

In December 1999, Kanagawa Prefecture received applications from seven consortia, which contained MCFs and trading, real estate, and lease companies. The Prefecture then requested the seven consortia to submit detailed proposals due on February 10, 2000. The proposals were evaluated in two steps as follows.

Evaluation Step 1: Evaluated with respect to performance and function, 3 proposals out of 7 were selected on March 30, 2000. The criteria of performance and function and their weights are shown in **Table 4-29**.

Table 4-29 Criteria of Performance and Function and the Weights

Category	Criteria	Weight
Performance/ Function	Clearance of Criteria	20 %
(Subtotal 60%)	Functionality/ Amenity	10 %
	Safety	10 %
	Environmental Considerations	10 %
	Practicability	10 %
Maintenance/ Operation	Basic Policy	3 %
(Subtotal 20%)	Administrative System	3 %
	Level of Service	6 %
	Economical Efficiency	8 %
Comprehensive Evaluation	Appearance/ Design/ Ingenuity	20 %
(Subtotal 20%)		

Source: KPC Proposal Evaluation Committee (amended)

Evaluation Step 2: The Evaluation Committee evaluated the three superior proposals again. In this step, the Committee included as evaluation criteria the cost factor (cost comparison and long-term viability of the proposals) and consortia's answers to Committee's additional inquiries, as well as the performance and function factors. Each member voted and the proposals were valuated with points of 2, 1, or 0 for each vote, which were then summed. The result was announced on April 7, 2000. Even though the cost of Obayashi's proposal was 4th out of the seven total proposals and 2nd out of the selected three proposals, other factors were better evaluated. The cost factor contained the following three components:

[43] KPC Proposal Evaluation Committee (2000): "Evaluation Comments on the Proposals for KPC Project," 5th PFI Subcommittee

(a) Project funding (financial viability): financial robustness and credibility of the company, design and construction experiences, viability and security of financing;

(b) Amortization charge: interest (base rate + spread), capital (construction, design and supervision, and administrative); and

(c) Operation and maintenance costs: operation and maintenance costs, prices increase.

2) Project Structure

Obayashi Corporation, an MCF in Japan, established an SPC, the project company, and is the sole sponsor of the KPC project. The project structure is shown in **Figure 4-21**. When the construction is completed, the ownership of the property is transferred to the Prefecture, and the project company operates and maintains the college. The Prefecture makes the installment payments for the 30-year contract period.

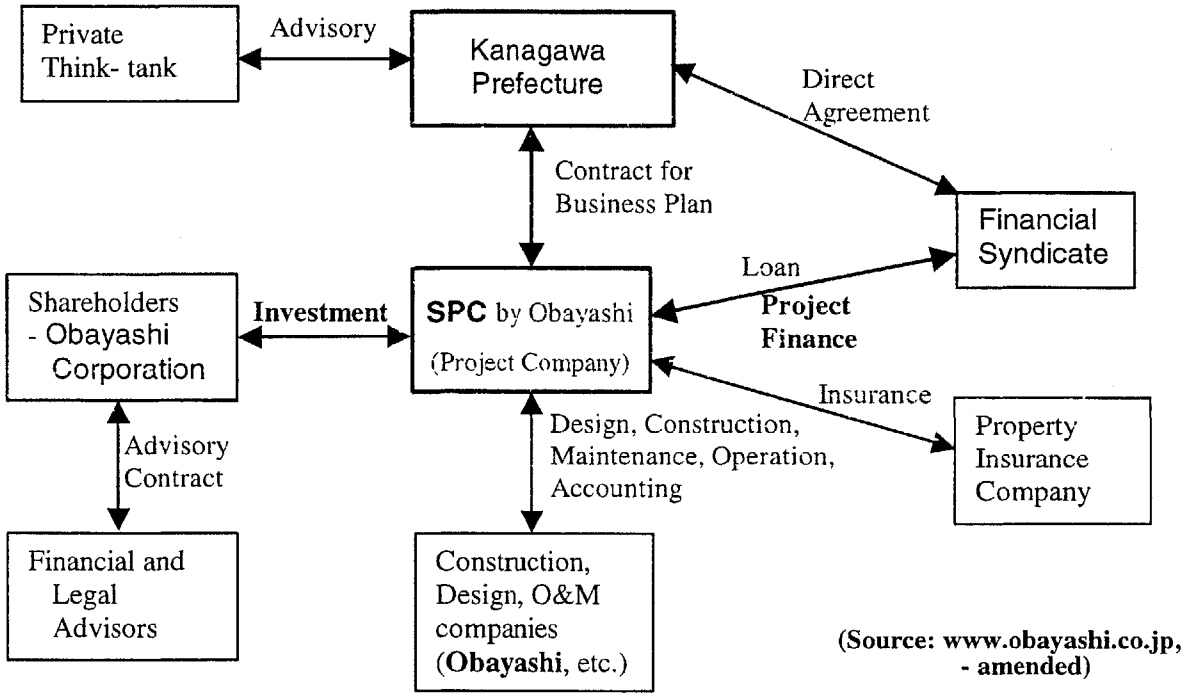


Figure 4-21 Project Structure of KPC Project

3) Financing Scheme

Total costs of the project are as follows:[44]

Construction cost: ¥11,880 million,

Interest of Installment during 30 years: ¥5,550 million, and

[44] *Nihon Kogyo Shimbun* (Newspaper), July 24, 2000

Maintenance and Operation: ¥16,450 million.

As with the Kanamachi Co-generation Plant project, the financing scheme of the KPC project is basically project finance, in which the financial syndicate relies only on the revenue from the project (i.e., installment payments of the Prefecture). Since this financing scheme has a long-term structure for 30 years, it is stable financing for the project company without the refinancing risk. Moreover, the project company prepares a separate reserve fund for the repayment. In addition, Obayashi Corporation, a sole sponsor, provides the equity of ¥790 million.[45]

4) Risk Profiles and Allocation

Kanagawa Prefecture expresses its basic concept of risk allocation in the request for proposals: While responsibilities for design, construction, operation and maintenance for the college are allocated to the project company in principle, the Prefecture may assume the responsibilities when reasonable. This project aims to be less expensive with higher quality services employing proper risk allocation. **Table 4-30** is the risk allocation list extracted from the Implementation Policies. The project company was given the opportunity to structure the risk allocation and to negotiate with the Prefecture.

Table 4-30 Risk Allocation of the KPC Project (Extraction from the Implementation Policies)

Risk Type	Description	Public	Private
Pre-construction Risk	Errors in the Implementation Policies, Objections to the establishment of the college, Changes of specifications	○	
	Delay of permissions, Preparation costs		○
Completion Risk	Liabilities to the third party, Cost overrun, Delay of the completion, Inadequacy of the performance		○
Operation Risk	Fluctuation of the consumer price, Changes of specifications, Loss caused by fires and accidents, Preservation of the environment and safety	○	
	Increase of O&M costs		○
Force Majeure	Changes, suspension, and delay caused by natural disasters and riots	△	○
Political Risk	Changes of laws relevant to the PFI and school operations, Direction of the Prefecture, Denial of the Assembly	○	
	Changes of laws in general, e.g., taxation		○
Financial Risk	Delay of the payment, Fluctuation of interest	○	
	Other financial risks		○

[45] *Kensetsu Tsushin* (Newspaper), August 4, 2000

4.2.10. Japan's Private Sector Projects

This subsection introduces relatively new procurement methods adopted in public facility projects managed by the private sector. The owners in the examples are East Japan Railway Company (JR East) and the Tokyo Electric Power Company (TEPCO). JR East is a privatized (denationalized) and divided agency established in 1987 and will be fully privatized in the near future. TEPCO was established in 1951 as a private company. The objective of this subsection is to demonstrate the private sector's advantage in efficient procurement of infrastructure facilities with innovative delivery systems. Although a detail or specific description of the projects is omitted, project structures and risk allocation are basically same as public sector procurement, i.e., the owner companies are generally responsible for everything. Financing a project is also the owner's responsibility.

East Japan Railway Company (JR East) sometimes employs "designated competitive bidding with proposal evaluation" system to select contractors. In this system, JR East provides the performance requirement, together with an original design, so that potential competitors can propose their plans, designs, and specifications to meet the requirement and improve on the value for money. For the Numakunai Bridge project, one of the Shinkansen (bullet train lines) projects that followed the procedure, Kajima proposed the adoption of newly developed "high-performance, light-weight concrete" and the external cable system for its superstructure. Kajima offered 10% cost reduction (compared to the estimation based on JR East's original design) because not only were the spans lengthened but also the substructures were diminished. By this procurement system, JR East not only exploited the MCF's hot technologies, but also significantly reduced the construction cost.[46]

TEPCO has a unique procurement system of construction projects. It encourages contractors to offer value-engineering proposals by giving "points" to the contractor who has achieved effective value-engineering proposals depending on the peoposals' advantages. When a contractor's points reach a certain criterion, TEPCO gives the contractor a special appointment contract as a "bonus order." This system has had a

[46] Yanai, Shuji and Sakata, Noboru (2000): "Kouseino Keiryo Konkurito no Genba Tekiyo (Application of the High Performance Lightweight Concrete)," *Technical Report*, No.201, Kajima Technical Research Institute

significant effect for TEPCO. For instance, the average ratio of the cost reduction by means of "request for technical proposals" is about 7%.[47]

Other than the foregoing characteristic methods, both JR East (and other JR Group companies) and TEPCO always employ competitive environments in their procurement process. They usually designate 3-5 MCFs and let them compete one another. Even when they adopt a special appointment contract, they are careful enough not to lose the competitive environment. For example, owners monitor carefully the achievements of the contractors during design and construction stages.

Flexibility that has allowed owners to make use of MCFs' potential has apparently brought about the efficiency gains for construction projects. The public sector, in contrast, has substantial limitations imposed on it, which reduces its ability to be flexible.

[47] Nikkei BP (2000): "Requirements that Make Value Engineering Come up to Surface," *Nikkei Construction* 2000.8.11

4.3. Comparisons and Analyses of the Case Studies

This section compares and analyzes the cases studied in the previous section, with regard to the project structure, financial scheme, risk allocation, and MCFs' roles and contributions, putting stress on the perspective of the participating MCFs. **Table 4-31** summarizes the cases studied.

Table 4-31 Summary of the Cases Studied

Project	Scope	Scale	Structure	Total Cost*1	Remarks
Kurushima Kaikyo Bridge	New bridge, Procured by HSBA (public agency), Design-Bid-Build	4,105m, 4 lanes	Large scale 3-successive suspension bridge, Some foundations in the strong current strait	¥280B (2,220M)	¥53.6B/km ($425M/km) 6,000 vs./day in the 1st year
Tokyo Bay Aqua-Line	New facilities, "Third sector" project, D-B-B with detail design by the private sector	10km tunnel, 4.4km bridge, 4 lanes	4-13.9m dia. shield tunnels, 4.4 km continuous bridge, two man-made islands in the middle of Tokyo Bay	¥1,266B (10,030 M)	¥81.1B/km ($642M/km) 10,000vs./day (25,000 in projection)
Confederation Bridge, Canada	New bridge, F-B-O-T	12.9km, 2 lanes	Continuous precast concrete bridge with foundations in the ice-covered sea	C$840M (530M)	C$65M/km ($41M/km)
Highway 407 in Toronto	New facilities, Bypass of HW401, Procured by Province of Ontario	69km, 4-6 lanes	Roads with some structures, Fully electronic tolling system	C$1,000M (640M)	C$14M/km ($9.2M/km) 264,000vs./d.
SR91 in California	New lanes in the median of an existing facility	16km, 4 lanes	Roads in mountainous area	$126M	$7.9M/km 37,000vs./day in projection
SR57 in California	New facilities, utilizing an existing channel, as a congestion reliever	18.7km 4 lanes	8.3mile viaduct in an existing channel, the rest is along other freeways	$700M	$37M/km Not Commenced
Sydney Harbour Tunnel	New tunnel, Bypass of an existing bridge	2,280m, 4 lanes	Eight 120m-long RC immersed tube tunnels, 1,260m land tunnels	A$750M (360M)	A$330M/km ($160M/km) 60,000vs./d.
DBFO roads in U.K.	Include both new constructions and improvements	21-122 km, ave. 72km	Varies between 8 projects	£9.4-214 M (13-303M)	£0.18-7.4M/km ($0.26 -10.5M/km)
Kanamachi Co-generation Plant	New co-generation system in a water purification plant	7,000 kW power	–	¥25.3B (200M)	Government pays for the service.
Kanagawa Prefectural College	New college construction and operation	40,000m^2 floor area	–	¥21.5B (170M)	BTO, Installment lease

Delivery systems JR East and TEPCO employ are introduced without specific description of a project.
*1 Numbers in parentheses are U.S. dollar amounts converted at the exchange rates in Appendix A.

4.3.1. Project Structure and MCF's Initiative

Comparison of Organization Structures

In privatized toll road/bridge/tunnel projects, the organizational structures are mostly the same except for the toll collection systems. Namely, the government gives the project company the concession to design, construct, finance, and operate the project; the project company, led by an MCF, seeks financial institutions to provide the necessary funds; the sponsors of the project company contribute nominal equity to the project; the project company contracts with design firms, construction firms, and operation and maintenance firms, for the respective works; both the government and the project company employ financial, legal, (and technical) advisors; and the financing institutions try to have a direct agreement with the government. Financial schemes and toll collection methods vary as compared in the following subsection.

In traditional Japanese delivery system, as seen in the Kurushima Kaikyo Bridge case, the organizational structure of the project was quite different. HSBA, the public agency for the project, acted directly with each of the participants as if it had been Almighty. In other words, the public agency behaves both as the project company in a privatized project and as the public owner. It would acquire the right of way, finance, and obtain permissions better than the private sector because of the experiences in the prospective Japanese PFI scheme.

Similarly, in most privatized projects in Japan, such as Japan Railways' projects and electric power projects, the private owners have strong incentives and considerable responsibilities for the projects like the public agencies in public works. Although a chart of the project structure is not provided in the subsection in question, the structure may be exactly the same as that of the Kurushima Kaikyo Bridge case. In some cases, for example in cases described in Section 4.2.10, partial differences can exist with regard to the package of the main contract (e.g., design-build contract).

There is no difference except in revenue structure between PFI toll road/bridge/ tunnel projects and other PFI projects such as pioneer Japanese PFI projects.

MCFs' Initiative

Every project company, which is the main player in a privatized project, includes an MCF as a sponsor, and an MCF leads the project company in the Confederation Bridge

project, Sydney Harbour Tunnel project, and many of the DBFO projects. MCFs' initiative is quite large, compared to design companies and operation companies. Nonetheless, the governments play the most important role in encouraging the private sector to be involved in the projects. Even in the Sydney Harbour Tunnel case, where the two MCF sponsors had the strong initiative to develop the project and aggressively proposed the project plan, the government sent them a clear signal to express the necessity of another crossing in the harbor. In sum, provided that the government is committed to developing a project, MCFs should have strong incentive to participate in the project and even lead a prospective project company, whatever the delivery system is, or whether the project is procured publicly or privately.

4.3.2. Financial Schemes and MCFs' Contribution

A sound financial scheme is indispensable for private toll roads. For example, in the Confederation Bridge case, when SCDI, the project company, was finally awarded both by the overall proposal and by negotiation with the government, the key issue that effected on the final award decision was the soundness of the consortium's financing structure of the project. Studies have shown that even under pessimistic assumptions, the NPV of the project is still positive.[48]

Financial schemes employed in cases studied are summarized in **Table 4-32**.

[48] J-KICKS (1999). "Project Evaluation of the Northumberland Strait Crossing Project," Course Project at MIT

Table 4-32 Financial Schemes of the Cases Studied (Toll Roads)

Project	Total Debt	Total Equity	Total Capital	Debt/ Equity	Government Financial Support
Kurushima Bridge	¥218B*[1] ($1,730M)	¥62B*[1] ($490M)	¥280B ($2,220M)	(78/22)	(Financed by the governments) More than half of debt is from Treasury Investment & Loan
Tokyo Bay Aqua-Line	¥1,176B ($9,320M)	¥90B ($710M)	¥1,266B ($10,030M)	93/7	Only a third of the equity is provided by the private sector. 18% of the debt is from Private.
Confederation Bridge, Canada	*[2] C$7560M ($477M)	*[2] C$84M ($53M)	C$840M ($530M)	90/10	Subsidy to repay the bonds, Minimum floor level setting, Non-competition clause
Highway 407 in Toronto	–	C$1,000M ($640M)	C$1,000M ($640M)	(0/100)	(Financed by the governments)
SR91 in California	$107M	$19M	$126M	85/15	$7 million in debt from Orange County
Sydney Harbour Tunnel	A$686M ($333M)	A$47M ($23M)	A$750M ($360M)	94/6	A$223 million non-interest bearing loan from the gov't, Revenue transfer from Bridge, Minimum revenue guarantee
DBFO roads in U.K.	–	–	£9.4-214M ($13-303M)	vary*[3]	Shadow toll payment (not necessarily "Support")

*[1] Debt and Equity are approximated from the statement of HSBA's total budget.
*[2] Figures are assumed from the information available. Equity portion was only for the contingency.
*[3] Equity proportion is not significant in part because early transfer of the assets may be prioritized in U.K.

Tolls and Toll Collection

In toll road projects, toll revenue is usually the only source available to repay the debt and to give return to the equity investors. As such the sound toll collection system is key to the success of the project. Restrictions regarding toll rates or toll revenues vary among the projects. In the Confederation Bridge, the agreement includes the minimum floor level of the toll revenue, which is indexed by the CPI, and the project company is allowed to raise the toll rates if the previous year's toll revenue falls below the floor level. The government of NSW guarantees the minimum toll revenue in the Sydney Harbour Tunnel case, which is also indexed to the CPI and is more favorable scheme for the project company to transfer the demand risk, though the ceiling is also established above which all the surplus is transferred to the government. In the SR91 project, instead of minimum guarantees, the project company is allowed to earn up to certain rate of return. This works as a toll revenue ceiling despite no minimum guarantees. In British DBFO roads, shadow toll rates, which the government pays tolls on behalf of the drivers, are the selection criteria

for the project companies. Therefore, neither minimum guarantees nor a ceiling exists, while the four-band toll rating system, employed with the shadow toll system, may work as such a buffer both for the project company and for the government.

Sophisticated electronic toll collection systems are adopted in the Highway 407 and SR91 projects. The two projects also employ a congestion pricing system for more efficient toll collection.

Investment (Equity)

All toll road case studies procured by the private sector show the investment rates of less than 15%. In general, the project company provides equity for up to twenty percent of the necessary financing, depending on the magnitude of the risks involved.[49] However, the proportion of MCFs' contribution is not usually dependent on the risks they can best control, rather, MCFs are forced to provide equity due to the huge magnitude of the contract amount and because MCFs need to commence the work earlier than others (operation or financing firms). Moreover, MCFs see their position in very competitive environment and feel pressed to the contribution to make the project profitable.[50]

In the cases studied, MCFs are successful in minimizing their equity investment positions in the Sydney Harbour Tunnel, the Confederation Bridge, and Highway 407 (eventually zero equity investment) cases. Because toll road projects bear considerable risks, especially in the traffic volume, the project companies try to reduce risks as much as they can by avoiding equity contribution or obtaining some revenue guarantees, and they seem to have succeeded in doing so. However, the MCFs might have lost the opportunity to get more profits from the successful long-term projects even though the success has come from the contributions of paramount importance, such as innovative construction or operation technologies. An equity contribution strategy for the MCF participating in the project is examined in Chapter 6.

Incentives

The agreements about financing structure between SCDI and the government, described in the Confederation Bridge case subsection, are very reasonable, giving SCDI

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[49] For example, Fisher and Babbar (1996): "Private Financing of Toll Roads," *RMC Discussion Paper Series* 117, World Bank

[50] Madono, Satoru (2000): "Paradigm Changes and the Japanese Companies," *Journal of the Japan Society of Civil Engineers*, Vol.85, October 2000, JSCE

incentives to work efficiently, and give the government multiple levels of security against potential problems related to the contractor. This financing structure convinces relevant parties that the overall pricing, or toll rates, are reasonable and the concession is awarded well.

Government Supports

Government financial supports may be available in various ways. They include, from higher level of governments' financial exposure, equity guarantees, debt guarantees, exchange rate guarantees, grants, subordinated loans, minimum traffic or revenue guarantees, shadow tolls, revenue enhancements, and concession extensions. The following exemplify explicit government supports.

California: Orange County's financial supports;

Sydney: The minimum traffic volume guarantee and raising of the Harbour Bridge's tolls before the commencement of the Tunnel to give the project company a fund;

HW407: Government financed project;

DBFO Roads: Shadow tolls (similar concept: KPC and other Kanagawa-type PFI, namely, the private sector initially finance the project, which is leased back from the Prefecture to the project company)

Other Financial Instrument

Some toll road projects, such as the Confederation Bridge and the Sydney Harbour Tunnel, develop innovative financing instruments, i.e., real rate revenue bonds in the former and CPI indexed bonds in the latter. Both of them were the crucial developments contributing to the success of the project. By adopting the PFI framework, such a development in the financing field is expected.

4.3.3. Risk Allocation

The risk allocation of the cases studied in this chapter is summarized in **Table 4-33**.

Table 4-33 Risk Allocation of the Cases Studied

Project	Preconst-ruction	Comple-tion	Demand	Force majeure	Political	Financial
Kurushima Bridge*[1]	○	○(●)	○	○	○	○
Tokyo Bay Aqua-Line*[1]	○	○(●)	○	○	○	○ (●very little)
Confederation Bridge, Canada	○●	●	●(○)	○(●)	○(●)	●
Highway 407 in Toronto*[1]	○●	●(○)	○	○(●)	○	○
SR91 in California	●(○)	●	●	●	○(●)	●
Sydney Harbour Tunnel	●(○)	●	○(●)	○(●)	○(●)	●
DBFO roads in U.K.	○(●)	●	○●	○(●)	○●	●
Kanamachi Co-generation Plant	○●	●	○	○(●)	○(●)	●(○)
Kanagawa Prefectural College	○●	●	○	● (○)	○(●)	●(○)
Others	Risk allocation of privatized infrastructure projects, such as JR East and TEPCO's projects, is basically the same as public sector projects, such as the Kurushima Bridge project, except for that the private owners, instead of the public sector, are responsible for almost all risks involved.					

○: Public sector's main responsibility, ●: Private sector's main responsibility,
(In parentheses): Partial responsibility
*[1] Kurushima, Tokyo Bay Aqua-Line, and HW407 are NOT private project.

From the table above, a quite clear distinction as to the risk allocation is observed between the public sector and private sector projects, and between Japan's or non-toll road PFI projects and foreign private toll road projects. By privatizing a toll road/bridge/tunnel project, the private sector needs to own more responsibilities for every risk involved in the project. In particular, completion and financial risks are transferred to the private sector almost completely. In return, the private sector obtains the opportunity to develop the design and construction means that enable the consortium to make full use of their technical and managerial capabilities, as well as for arranging the most appropriate financing scheme for the project. It is, of course, essential that the private project company

assess the risks and mitigate them within the consortium, or in relationships with other private entities, such as financial institutions or insurance companies.

Demand risks may be the most important for toll road/bridge/tunnel projects, and must be managed well. All pioneer Japanese PFI projects are "services sold to the public sector" projects and the public sector is responsible for the demand risks, as in the Kanamachi Plant and the Kanagawa College projects. This shows the difficulty in implementing a toll road project as the PFI because of the complexity of analyzing and transferring the demand risk. The fact that only the public sector has been soundly managing toll roads in Japan for a long time is also one reason both sectors hesitate to take firm actions to implement toll road projects as the PFI.

Experiences of the risk allocation in these cases are referred to in Chapter 5 when a framework of the Japanese PFI for the toll road/bridge/tunnel project is developed.

4.3.4. MCFs' Roles and Contributions

Most project companies in the Case Studies are led by an MCF, and MCFs play crucial roles in the project, especially new road/bridge/tunnel construction projects such as in the Confederation Bridge, Sydney Harbour Tunnel, and U.K.'s some DBFO roads projects. **Table 4-34** summarizes main roles the MCFs played in the projects studied in their development or construction stages.

Although identifying figures by which MCFs' contributions reduced the total project cost cannot be attained, it is obvious from the table below that some technically complicated projects would not have been realized had the MCFs not played crucial roles in developing the projects. More importantly, in some foreign private toll road/bridge/ tunnel cases, such as the Confederation Bridge, the Sydney Harbour Tunnel, and SR57, the MCFs overcame the strict limitation of the governments' financial supports with original technologies or equipment. The MCFs therefore deserve a substantial portion of the benefits the projects generate.

Table 4-34 Main Roles the MCFs Played in the Projects Studied

Project	Main MCF(s)	Roles Played and their Effects
Kurushima Bridge*[1]	Kajima, Kumagai, and many others	Development of sound, innovative construction means, which made the project technically feasible (Installation of huge underwater foundation, Development of non-segregating underwater concrete, etc.) MCFs obtained good returns on the investment from the construction contract.
Tokyo Bay Aqua-Line*[1]	Kajima, Taisei, and many others	Development of the world's largest shield tunneling method with full-automated system, underground docking, and other innovative technologies, which made the project technically feasible; MCFs obtained good returns on the investment from the construction contract.
Confederation Bridge, Canada	Morrison Knudsen, GTM, Ballast Nedam	Responsibility for every aspect of the project, including financing scheme structuring (Real rate bonds issuance, Environmental Permission, etc.); Development of innovative construction means (Precast segment method, Utilization of "Svanen", etc.); They made the project technically, economically, and politically feasible.
SR91 in California	Kiewit, Granite	MCFs contributed to evaluate over 75 projects.
SR57 in California	Kiewit Pacific	The consortium was considering innovative methods for building the viaducts that might significantly reduce construction costs.
Sydney Harbour Tunnel	Transfield, Kumagai	Responsibility for every aspect of the project, including financing scheme structuring (CPI bonds issuance, etc.); Development of innovative construction means (Efficient construction and installation immersed tube tunnels, Environmental problem solving, etc.); They made the project technically, economically, and politically feasible
DBFO roads in U.K.	Many	In some of the eight DBFO projects, MCFs led the consortium to design and structure the financial scheme.
Kanamachi Co-generation Plant	Shimizu	Responsibility for the construction of the emergency tank, the foundations, pipes, etc.
Kanagawa Prefectural College	Obayashi	Responsibility for every aspect of the project, including financing scheme structuring

*[1] Kurushima, Tokyo Bay Aqua-Line, and HW407 are NOT private project.

Chapter 5. The Japanese PFI and Toll Road/Bridge/Tunnel Projects

Most people in Japan doubt the Japanese PFI will obtain popularity and be widely disseminated. Nevertheless, the PFI has tremendous potential to become the most important factor of the reformation of Japan's administrative and financial structure, which almost every economic expert claims is imperative for the Japanese economy to revive.

Chapter 5 first addresses expectations about the Japanese PFI in the context of both the construction industry, as a delivery system, and the economy in Japan. From the second section on, the scope is narrowed to toll road/bridge/tunnel projects in order to build a PFI framework for a specific type of project because the current delivery system and risk profiles are substantially different among various project types. The chapter then speculates about the feasibility of the introduction of the PFI framework for toll road/bridge/ tunnel projects of each project type. Analyses of the framework's characteristics follow by examining its similarity with and difference from many other PPP (public-private partnership) projects discussed in Chapter 4, both in Japan and abroad. Finally, after identifying most feasible types of projects, the chapter develops a desirable framework for the toll road/bridge/tunnel projects as the PFI with focus on risk allocation/mitigation and finance structuring.

5.1. PFI in Japan's Construction Industry – How the PFI Works

The Japanese PFI was first introduced as a means to encourage the stagnant Japanese economy in late 1997 and actually enacted in1999, as described in Chapter 3. In the circumstance of the fiscal deficit of the national and local governments and the economic recession, the PFI was expected to work as a novel scheme, by which public

facilities would be developed and the government financial structure would be streamlined.

The PFI originated in the U.K., following its trend of the financial reorganization by means of privatization, deregulation, and outsourcing. In the U.K., the PFI has now become an established method of delivering many public services. The investment amount in PFI projects had grown steadily form 1993 to 1998, when the public expenditure for the PFI reached £3.0 billion[1], and from that time on, the annual expenditure has remained at the same level, which is some 10% of the total public expenditure.[2]

Advocates estimate that the Japanese PFI will also grow rapidly in the coming several years as was the case in the U.K., with the expectation that it will restructure both the construction industry and Japan's economy.

5.1.1. Industry Perspective

While the PFI Act was originally intended to encourage the stagnant Japanese economy, it has huge potential to improve most problems in the Japanese construction industry mentioned in Chapter 2. As described in Chapter 3, the official objectives include providing inexpensive and quality public facilities to the public, utilizing the private sector's resources, reforming the national government's financial and economic structures as well as local ones, creating packaged delivery systems, and sharing roles and responsibilities for the projects more explicitly. The Act consequently requires the construction industry, public and private, to be efficient, productive, transparent, fair, competitive, innovative, and driven by the market principle. To meet these requirements, the PFI contains functions novel to the Japanese system as listed below.

(1) The Private Sector's Initiative

The PFI scheme allows and expects the private sector to take initiative, whereas with the traditional Japanese delivery system, the public sector plans and initiates public utilities projects and solicits bids from private firms. A private firm could propose a plan

[1] For the convenience purpose, US$1 = £0.7061= ¥ 126.25 = EUR1.1494 as of March 31, 2001. See Appendix A for a cross rate chart.
[2] HM Treasury, U.K. (2000): Budget 2001

that is profitable enough to the firm, and, in return, beneficial to the public by using proper technology, equipment, or ideas.

In practice, however, the private sector, with few exceptions, awaits plans as before which the public sector intends to implement as a PFI project. So far, this seems to be reasonable because the uncertainty about whether a particular public agency is willing to hear from the private sector who proposes a potential public facility as a PFI project is quite large. Even though the number of projects that local governments have already initiated in a range of stages is significantly growing (more than 45 as of March 2001, see Chapter 3), this represents a mere 1.5% of the total number of Japan's some 3,000 municipalities. To take advantage of the private sector's initiative, it is essential for both the public and private sectors that the government informs the public of the implementation policy of public facilities and shows eagerness to adopt the PFI framework if desirable.

For example, Australia's Government of NSW in Australia repeatedly announced the ideas for the prospective next Sydney Harbour crossing and showed the necessity and desire of a feasible project. Transfield and Kumagai Gumi proposed an attractive, feasible idea to the government, knowing that the proposal might be adopted as a private project.

(2) Elaborate Contract Documents

In Japan, as long-term credibility is heavily pressed on for the relationship with clients or customers, public or private, and in construction and other industries, tacit agreement may be regarded as part of the Japanese national character. Too strict or detailed contracts are thus difficult to establish. For instance, describing and regulating treatments in case of defaults on either side reflects the idea that one cannot completely put trust in the other, so some Japanese tend to avoid such a prescription.

However, elaborate contract documents are imperative to the PFI. Contract documents in Japan are often criticized for their vague language, which allows for deferral of decision or agreement when unexpected circumstances arise. This sometimes causes excessive public expenditure because the public sector tends to pay directly for relatively large costs resulting from an uncertainty and also indirectly for relatively small

costs, which private firms add to their bid prices in the form of risk premiums. The establishment of elaborate contract documents may result in either increase or decrease of the construction cost. Either way, it must result in better, clearer risk allocation, which is definitely desirable.

Arguments about the contract often involve the issue of the capability of the local governments. Statistics about Japanese public utilities projects show the importance of the local governments' projects by high proportion within all domestic projects and relatively high needs for personnel and financial resources.[3] Independent advisers could and should help them, but the independence of the advisers becomes a difficult issue to address.

The difficulty of completing a contract document for a PFI project is one of the most serious disadvantages of the PFI, compared to the traditional delivery system. Some preliminary surveys all indicate that most local officials hesitate to implement a PFI scheme due to the complexity of the documents required as mentioned in Section 3.3.2. In addition, The Guideline for the Implementation Process of the PFI Project suggests the great demand for templates of standard PFI contract forms.

For example, in Kanamachi Co-generation Plant and Kanagawa Prefectural College projects, the first two major projects procured with the Japanese PFI scheme, numerous negotiations with legal advisors for both parties were necessary for the first time in Japan's construction contract development. Similarly, in California's projects studied in Chapter 4, ten legal advisors were hired for one consortium.

(3) Fair and Transparent Competitions

Fair and transparent competition is also indispensable for the PFI. Many studies[4] indicate that the competition is the most important and essential factor for the privatization or the PPP to be efficient, cost-effective, and acceptable to the public. (The PFI is one kind of privatization or PPP.) Without a fair and transparent competition, as is so far the case in Japan as introduced in Chapter 2, either VFM (value for money) or the public satisfaction cannot be achieved.

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[3] Some 80% of public works are local governments' projects in Japan. See Sections 2.1.1 and 3.3.2.
[4] For example, Liddle, Brantley (1993). "Sustainable Development, Infrastructure and environmental Investment, and the Privatization Decision," *MS Thesis*, MIT

In the current dull economic environment in Japan, the general public assumes that the construction industry is given unfair preferences by both the national and local governments in the name of fiscal policy thanks to the industry's political power. Furthermore, media repeatedly announce that the governments have been spending taxes for useless public facilities such as rural agricultural highways and inactive fishery ports in order only to let construction firms survive. As a result, "Dango," a sort of collusion, has been reportedly preserved in areas, and the extraordinary number of construction-related firms remains at 600,000 level, or even grows, without restructuring or streamlining of the industry. Even "dead" companies with hundreds of billions of yen of interest-bearing debts, which almost equal to the companies' annual revenues, could survive by requesting debt forgiveness from their affiliate banks in the non-competitive economic structure, including the construction industry.

In the PFI scheme, only capable companies would succeed in the PFI market because the market must objectively select really profitable project companies. As a matter of fact, some major construction companies have already made alliances with foreign consulting firms that have ample experiences in PFI or similar projects so as to receive the credibility in the PFI business from investors and to survive the competitive industry in the future.

(4) The Government's Roles

The government's roles should be reformed in several ways with the PFI. This is one of the three objectives clearly stated in the Basic Policy of the PFI (See Chapter 3). The government, especially the national government, has controlled the construction industry through the laws, regulations, and many other authorities to permissions, approvals, and designations. Public agencies, on behalf of the government, have had the same absolute power as the national or local government over the private sector. Both public agencies and governments have implicitly had superior rights in construction contracts such as unilateral evaluation of contractors, which influences future designation for bids, and one-sided opportunity to initiate some business. It has been quite common for a public agency or a government to ask the contractor for cooperation in preparing the documents for the audit without compensation.

The government, or the MLIT (Ministry of Land, Infrastructure and Transport), in turn, sometimes supports the industry so that any construction firms can make at least nominal profits regardless of their efforts to streamline the firm structure. No major merger, acquisition, or bankruptcy has occurred in the recent severely shrinking construction industry in Japan. This is one of the reasons the construction industry in Japan remains inefficient.[5]

With detailed contracts, the relationship between the government and the private entity must be changed toward a more reasonable direction, which foreign markets must welcome. The PFI will play a significant role in this regard because it strictly requires the proper, complete risk allocation. For example, in a traditional public contract or a third sector project like the Tokyo Bay Aqua-Line project, if a cost overrun occurs, the excessive cost would be assumed by the public sector with devised reasons. If the public sector, in turn, delays the acquisition of the right-of-way for the project, the contractor would recover the delay by facilitating the remaining work without compensation. These unaccountable, opaque relationships will be, and must be, reformed with the PFI. Deregulation, taxation, and government subsidies are also central issues for the government with regard to the PFI.

(5) Risk Allocation

Risk allocation, or risk sharing, is probably the most difficult, important, and controversial problem in the project development among major parties: the government, local or national, financial institutions, and the potential developers, and sometimes the citizens. As noted earlier, since tacit agreement is favored in Japan, risk allocation has never been established in project contracts except those of a few recent PFI projects. When unfavorable events ensue, such as construction cost overruns and delay of the acquisition of right-of-way, either party or both the owner and the contractor assume the incurred costs as a result of negotiations in good faith. However, this manner is obviously inefficient because the risk is not necessarily allocated to the best party who can manage it, and hence, neither party prepares, or both parties prepare too much,

[5] As a measure of the Emergency Economic Plan, MLIT announced a new regulation in April 2001 that encourages mergers and acquisitions in the construction industry by giving the merged company more opportunity to participate in competitive bids for the public works.

against the risks. Furthermore, needless to say, proceeding with a project without clear definition of risk allocation is not acceptable in the international open market.

Risk allocation requires parties to take a number of measures to mitigate or transfer the risks: full-turnkey, lump sum contract, or design-build for completion risks; government supports or financial institutions' investments for various stages; insurance claims for force majeure; and so on. In the PFI, all of these arrangements must be regulated in the contract and most of them are transparent and open to the public.

Anticipating the full-scale introduction of the PFI in Japan, local governments have been eager to apply the PFI to various projects. Several cases, including Kanamachi Co-generation System project (Tokyo Metropolitan Government) and Kanagawa Hoken-Iryo-Fukushi Daigaku (Kanagawa Prefectural College, KPC) introduced in Chapter 4, have already been contracted as model cases of the Japanese PFI.

All of the local governments have been trying to disclose as much information as they can, and implementation policies and generic contract terms and conditions are also released on their web sites. Anyone who was interested could make their proposals based on the level playing field without any type of cooperation with the governments beforehand. There is no fiscal budget/consumption ruling as is usually the case of public works in Japan mentioned in Chapter 2.

Those aspects described above are the very improvement of the problems within the construction industry in Japan. Therefore, it is hopeful for the industry that PFI will be diffused throughout the country and will improve the industry structure so that technologically and managerially healthy firms can survive well in the future.

5.1.2. Economic Perspective

The PFI should work not only for the improvement of the attitude of the industry, but also both for Japan's economy by creating new business practices such as project financing and for MCFs [6] by giving them opportunities to be more involved in the project itself rather than only in construction. This subsection views the PFI as an instrument of

[6] MCF, or "Major Construction Firm" is defined in Section 2.2.1.

an economic policy from different aspects, while strategies for MCFs are proposed and applied to a prospective project in Chapter 6.

(1) Administrative and Financial Issues in the Construction Industry

As observed in the foregoing subsection, the enactment of the Japanese PFI has a considerable potential for the improvement of the construction industry. However, it is also true that the PFI Act itself cannot solve problems belonging to the industry. For example, many construction firms that hold too much debt would not be able to establish an SPC (special purpose company) with any partners for a PFI project.[7] Also, many local governments would fail to exploit the opportunity because they wish to stick to the traditional systems to defend their territories or just because they do not try to adopt new systems. Furthermore, as a bureaucrat pointed out in an interview, there may be few prospective projects in the large-scale infrastructure area, including roads and bridges, to suit the PFI. Although the Act defines numerous kinds of facilities as public facilities,[8] many of those that have sufficient profitability for the private sector have already been privatized like railroads, telecommunication facilities, and energy plants. Remaining potential projects are relatively small or less profitable, and therefore difficult for the prospective consortia. Also, both the PFI Act and the Basic Policies are indifferent in terms of the international competitiveness, the expansion of the domestic construction market, or the relief of the industry's financial crisis. The PFI may be simply reflecting the trends of the Japanese economic and financial reformation, rather than trying to reform the construction industry itself.

(2) Fiscal Restructuring

Long-term outstanding debt of the national and local governments combined will have reached ¥666 trillion[9], which is surprisingly 1.3 times the GDP (Gross Domestic

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[7] President of Kumagai Gumi, suffering from heavy burden of interest-bearing loans and growing distrust from the market, recently revealed a plan to tackle PFI projects with Kajima Corporation in an interview with Chief Editor of *Nikkei Construction*.

[8] The Act defines the following as public facilities: 1) roads, railways, ports, airports, rivers, parks, and utilities; 2) governmental office buildings and dormitories; 3) public housings, public schools, waste disposal facilities, public hospitals, social welfare facilities, prisons and rehabilitation facilities, public parking, and underground streets; and 4) telecommunication network facilities, energy plants, recycling facilities, sightseeing spots, and research laboratories.

[9] For the convenience purpose, US$1 = ¥ 126 as of March 31, 2001.

Product) in FY2001. Japan's economy has not yet been able to recover from the "Trauma of the Bubble" that began in the early 1990s when the bubble economy collapsed. Japanese financial institutions are all struggling with massive *non-performing loans* and scared of movements of foreign institutions. During the depression, *Fiscal Structural Reform Law* was renewed in 1997 in order to restructure the public finance so that the nation's fiscal deficit would be reduced from 4.5% to 3% and the issuance of the *deficit-covering bond* would be halted until 2003. The importance of the fiscal restructuring remains the same even though the Law has been revised in the name of "boosting the economy" such that the following additional expenditure could be accepted:

- FY1998 Urgent Economic Stimulus Package: total budget of ¥17 trillion,
- FY1999 Economic New Birth Measures: total budget of ¥17 trillion, and
- FY2000 Rebirth of Japan Plan: total budget of ¥11 trillion.

The PFI is attractive from the standpoint of financial restructuring because not only is the expenditure stream of the PFI considerably different from that of the traditional system but also the total costs may be substantially lower than by the traditional system as shown in **Figure 5-1**.

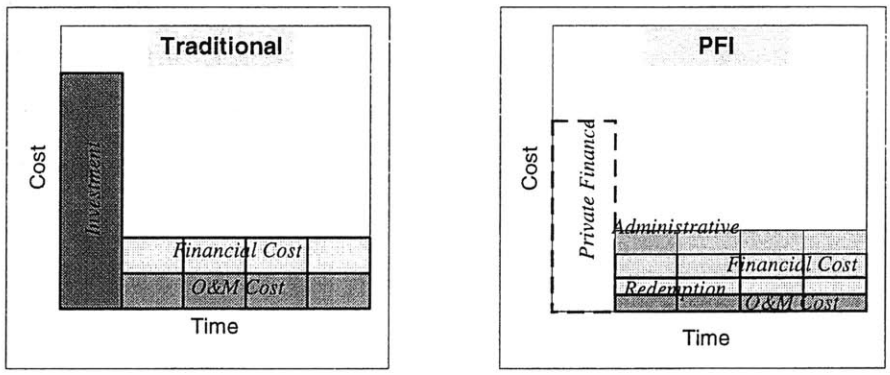

Figure 5-1 Expenditure Comparison between Traditional and PFI Procurements

However, since Japanese banks are all struggling with massive non-performing loans as mentioned earlier, it may be also difficult to raise the initial cost from private finance as indicated in the right diagram of **Figure 5-1**.

(3) Administrative Reform

The central government ministries and agencies were reorganized from 22 to 13 in January 2001 in Japan. The administrative system has been growing all the time and caused the overspending of the national budget. Policy planning divisions and policy implementation divisions will be divided, and the functions of the latter will be transferred to the private sector in order to streamline the administrative organizations. Public officials will be reduced in number and efficiency will be sought.

In reviewing the roles and responsibilities of the public officials in the trend of the administrative reform, the PFI as well as outsourcing and privatization is one of the striking measures to implement the policy. The government roles would be limited to the policy establishment and the implementation review, and the role of the implementation itself should be transferred to the private sector. Moreover, the needs of infrastructure development in Japan have not yet declined in a rapidly aging society. The Japanese PFI is therefore expected from perspectives of both administrative reform and financial restructuring.

(4) Local Economy

With few exceptions, local governments have the same reformation needs as the national government, financially and administratively. Nonetheless, as there are more than 3,000 local governments throughout the country, the sense of urgency and the energy of execution vary dramatically. Generally speaking, the larger the scale of economy of the municipality, the more eagerly the local government tries to reform its administrative and financial structure, and consequently, it recognizes the necessity of the PFI implementation.

For example, the Tokyo Metropolitan Government implemented the Kanamachi project as a PFI in order to take advantage of the lower initial investment cost along with its environmental and disaster-prevention policies. The government officials have shifted their responsibilities from the implementation of the operation services to the policy planning and the management of service purchasing. Kanagawa Prefecture, the second most populated prefecture in Japan, has achieved a similar objective by implementing the KPC project as a PFI. Both Tokyo and Kanagawa governments are sophisticated, large

governments, and drastically reduce the needs of public officials for operation of the projects by the partnership with private project companies, who will presumably achieve more efficient operation than the public sector would.

(5) Types of PFI Projects

A variety of types are given as potential projects in the PFI Act and the MLIT's Guideline. However, currently planned projects are mostly "*box-types*," that is buildings for people to gather in. Public infrastructure, such as toll roads and bridges, is rarely investigated as PFI projects for several reasons even though PPP projects in other countries (e.g., U.K. and developing countries) substantially include such types of projects.

From the next section on, the scope is narrowed to one of public infrastructure types of projects, that is, toll road/bridge/tunnel projects in order to examine more specific characteristics of the Japanese PFI and to establish a PFI framework regarding the toll road/bridge/tunnel project, referring to the experiences studied in Chapter 4.

5.2. Feasibility of Toll road/bridge/tunnel Projects as Japanese PFI

5.2.1. Current Toll road System and Projects in Japan

(1) Toll Road Planning System

A toll road network has been established based on National Comprehensive Development Plans and Five-year Road Improvement Plans, which have so far contributed 6,615 km (as of December 1, 1998) of toll roads and addresses establishment of the 11,500 km of toll roads, together with other 2,500 km of high-performance tolled highways, by early in the 21st century (See **Figure 5-2**). National expressways are mostly run by ***Japan Highway Public Corporation (JH)*** and high-performance tolled highways are run by Metropolitan Expressway Public Corporation, Hanshin Expressway Public Corporation, Honshu-Shikoku Bridge Authority, and Urban Expressway Public Corporations. The national government has developed the road development plans, although they are heavily influenced by politicians throughout the process. Current status of the completed and planned toll road network is depicted in **Figure 5-3**.

The first developed Tomei Expressway has the heaviest traffic volume and others in metropolitan areas also have more than adequate volume for profitability. On the other hand, roads in rural areas, such as northeast Japan and areas along the northern shoreline, have much less traffic volume due to the incompleteness of the network or high cost-generating terrain as well as their low population.

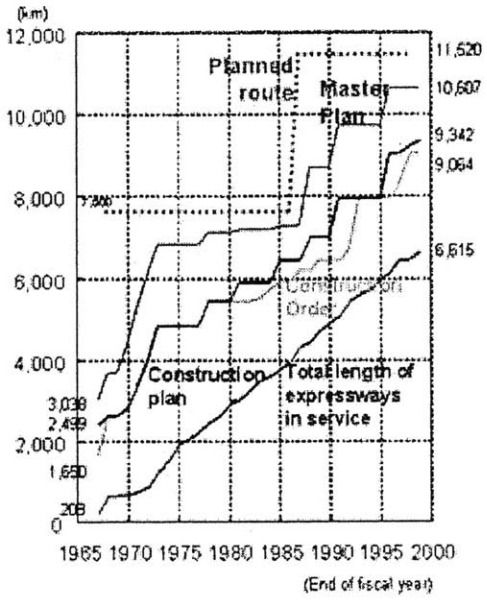

Figure 5-2 Changes in Construction of National Expressways (Source: MLIT)

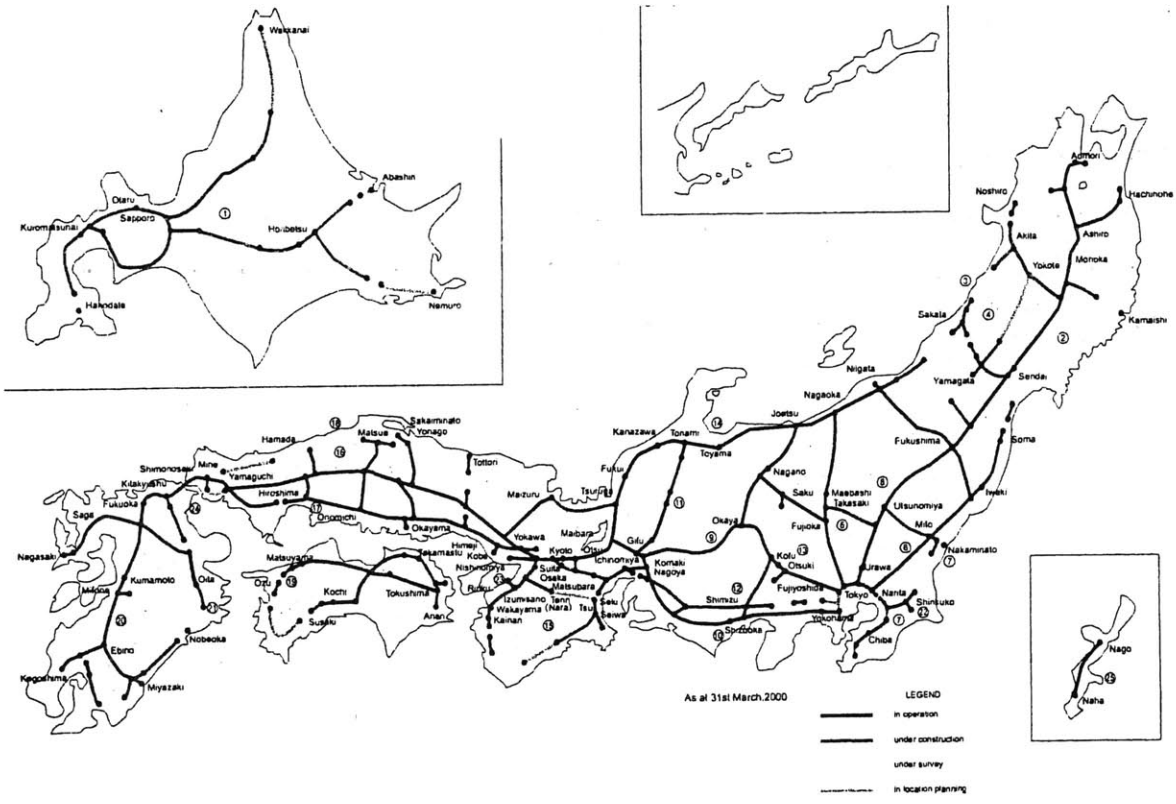

Figure 5-3 Japan's Toll Road Network (Source: JH)

(2) Toll Road Financing System

The toll road financing system is described in **Figure 5-4**. Toll roads in Japan are constructed with debt (road bond etc.) and national expenditures. Debt is repaid after the commencement of the service of the roads, using tolls collected from users: the collected tolls are also used for road maintenance and the repayment of interest. Toll rates are determined to balance the summation of construction cost (for new roads and facilities), maintenance cost, and financial cost (i.e., interest on debt and principal repayment). Japan's toll road system uses a nationwide toll pooling system, by which JH, for example, enables later developed, less popular toll roads financed by surplus toll revenues from former developed popular toll roads such as Tomei Expressway.

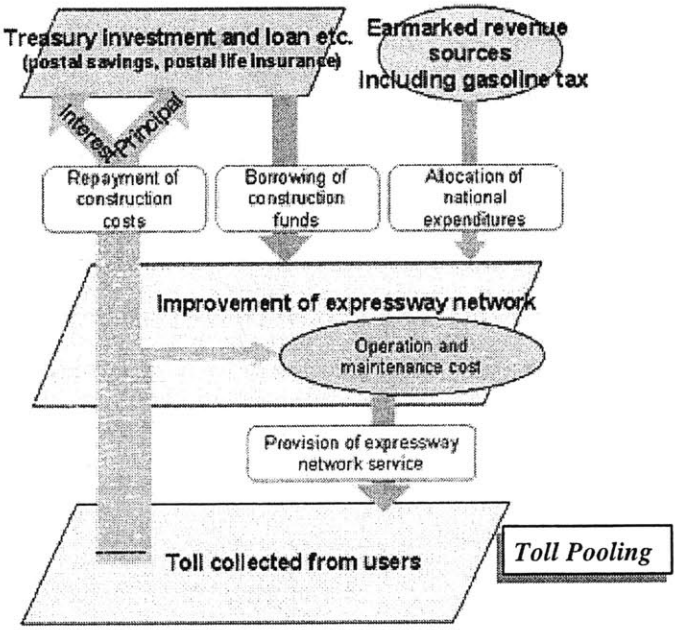

Figure 5-4 Flow of Expressway Construction Funds (Source: MLIT, JH)

JH's balance sheet as of March 31, 2000 is shown in **Table 5-1**. Most of the assets have been financed by several bonds, in particular, funds issued by the Treasury Investment and Loan Program (TILP)[10] accounts for 57.4% of the total assets (81.7% of the fixed liabilities). 23.1% of the total assets have been recouped with toll revenues[11] by

[10] Japan's Ministry of Finance calls the same program FILP (Fiscal Investment and Loan Program).
[11] According to the special laws for toll road operating agencies, the accounting format is made differently from those of commercial companies. Consequently, toll revenues are added to "Reserves" under the liabilities category without depreciation.

the end of FY1999.[12] Financing resources of the JH are depicted in **Figure 5-5**, with the FY1999 budget. In the FY1999 budget, ¥2.11 trillion, out of ¥2.95 trillion debt, came from the Treasury Investment and Loan Program run by the national government. ¥288 billion came from the national budget, which accounts for only 16% of the total national budget for road improvement projects.

Table 5-1 JH's Balance Sheet as of March 31, 2000 (Source: JH)

	in ¥ billion	
Assets		
Current assets	122	0.3%
Fixed assets, Motorways	32,284	86.3%
Motorways, construction in progress	4,423	11.8%
Other fixed assets	489	1.3%
Deferred assets	104	0.3%
Total	37,422	100%
Liabilities and Capital		
Liabilities		
Current liabilities	389	1.0%
Fixed liabilities		
Publicly offered bonds (Gov't Guarantees)	1,531	4.1%*
Bonds placed to Government Funds	18,866	50.4%*
Privately placed bonds	1,093	2.9%
Foreign currency bonds	477	1.3%
Government loans	1,080	2.9%*
Private loans	1,836	4.9%
Others	1,395	3.7%
Subtotal	26,295	70.3%
Reserves under special laws		
Reserves for recoupment	8,635	23.1%
Others	300	0.8%
Subtotal	8,935	23.9%
Total Liabilities	35,619	95.2%
Capital		
Government investment	1,773	4.7%
Surplus	31	0.1%
Total Capital	1,803	4.8%
Total	37,422	100%

* From TILP, total 57.4% (81.7% of the fixed liabilities)

[12] A fiscal year (FY) starts April 1 of the said year and ends March 31 of the next year in Japan. Therefore, the end of FY1999 is March 31, 2000.

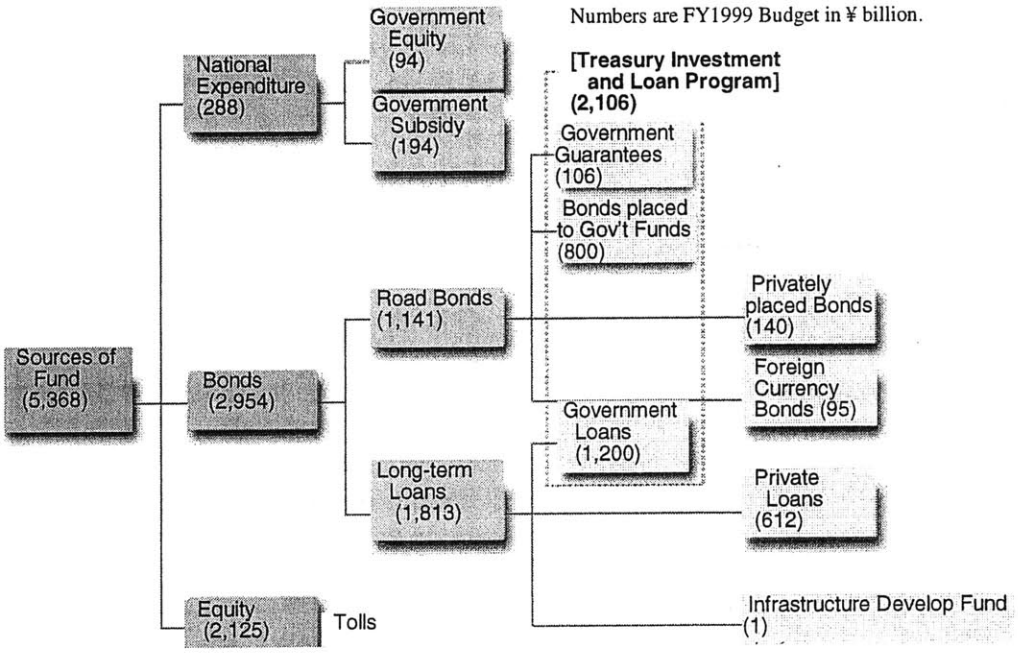

Figure 5-5 Sources of Fund for Japan Highway Public Corporation (Source: JH)

Statement of profit and loss for the year ended March 31, 2000 is shown in **Table 5-2**. Revenues of ¥2,318 billion, including ¥2,116 operating revenues, was mostly spent for recoupment (¥921 billion, 39.7%), for interest on bonds and borrowings (¥865 billion, 37.3%), and for operating and administrative expenses (¥327+106 billion, 18.7%) in FY1999. The other sources not shown in **Table 5-2** but shown in **Figure 5-5**, such as Government Equity (¥94 billion) and Bonds (¥2,954 billion) were mostly used for new construction (some ¥1,300 billion) and amortization (some ¥1,500 billion).[13]

[13] JH (2000). *Annual Report 2000*

Table 5-2 JH's Income Statement for the Year Ended March 31, 2000

	in ¥ billion	
Revenues		
Operating revenues	2,116	91.3%
Subsidies from Government	194	8.4%
Others	8	0.3%
Total	2,318	100%
Expenses		
Operating expenses	327	14.1%
General administrative expenses	106	4.6%
Provision of reserves for:		
Recoupment	921	39.7%
Others	36	1.6%
Non-operating expenses		
Interest on bonds and borrowings	865	37.3%
Others	62	2.7%
Net profit for the year	1	0.0%
Total	2,318	100%

(3) Toll Road Status in Japan

Current toll road status and its prospects may be summarized as follows, in addition to the descriptions introduced in Chapter 4.

1) Profitability of the current toll road system in Japan varies, and it seems not necessarily too infeasible. A substantial portion of the revenues has been spent for the recoupment, that is, bonds and loans have been amortized steadily, but at the same time, JH has been receiving additional bonds and loans every year for both the amortization of debt and the construction of new roads, so the recoupment ratio has grown slowly. Therefore, it is doubtful whether the national toll road network will be open to the public for free in the future.

2) Governmental supports are currently minimal for toll roads, although the government-issued bonds are dominating the sources of funds, because of the policy to use the tolls to repay the debts for the toll road construction cost. The government has spent its road improvement budget mostly for non-tolled general roads. Nevertheless, JH depends for its financing resources on governmental programs, such as the TILP.[14]

[14] The government will have established the "Reduction and Streamlining of the Special Companies Plan" by March 2002, from the viewpoint of the public-private partnership, by means of closing, privatizing, or independence-giving. Since the abolishment of special companies is likely to facilitate the privatization of

3) Prospects for future toll road projects are getting worse due to the prospective higher construction costs in the mountainous or complicated terrains and lower traffic demand in the rural areas. The construction cost per kilometer, together with the right-of-way acquisition cost, has grown rapidly. MLIT, as well as Ministry of Finance, is eager to apply taxes of the amount equal to the construction costs of the new roads to encourage the construction of future non-profitable expressways, which otherwise could not redeem the debt.[15]

4) There are some potential projects that cannot be initiated due to prospectively extreme construction cost instead of high traffic demand, such as congestion relieving roads in urban areas, and bridges and tunnels for relieving congestion or connecting actively working areas. These types of projects may be the target projects the private sector may have the opportunity to develop as Japanese PFI projects.

5.2.2. Types of Potential Toll Road Project

Potential project types of private toll roads can be categorized by contract type, by network circumstance, or by function. Feasibility, characteristics, and availability of tolling system or private operation largely depend on the type of the project.

Contract type contains new construction, rebuilding or expanding, and operation and maintenance only. *New construction* projects may include the entire delivery package such as design, construction, financing, and operation and maintenance. This type of project generally requires complicated work for permissions and acquisitions of right-of-way, needs high-cost construction work, involves uncertainties in various areas, faces the difficulties in forecasting future traffic volume, and therefore demands higher return on investment whether public or private. *Operation and maintenance only* projects, on the contrary, have much less uncertainty in the business conditions. Right-of-way issues do not exist in most cases, maintenance level and costs are usually predictable, and

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the postal savings system, the level of the reformation will demonstrate the execution power of the brand-new Koizumi Administration.

[15] ¥1 billion budget for this for FY2001 was withdrawn on the final stage because of severe objections of JH, which protected itself from restructuring. (Newspapers. Asahi, 12/05/00 and Nikkei, 12/10/00)

traffic volume can be estimated on the basis of actual experience. *Rebuilding or expanding* projects should be positioned somewhere in between.

Network circumstance represents the relation of the project with other connecting road system(s). The project may be *a segment of an already planned network*, where the completion of the project (if the project is new construction) would contribute to the ultimate efficiency and the goal of the planned network, but in other words, the completion of only a portion of the network would not generate sufficient traffic volume, or revenue stream. This project type also has another meaning in Japan, a political road, because, as mentioned earlier, some politicians have inappropriately large authority to make decisions as to the alignment of the network. The project may be *a bypass route* of a congested trunk road, tolled or non-tolled, that will be a tough competitor of the project road. Another likely possibility is an independent, eventually captive project such as *bridges and tunnels*. Bridges and tunnels also need connecting roads that conveniently flow the traffic from and to the bridges/tunnels. For expansion or rebuilding projects, the circumstance can be further segmented into free roads and toll roads with respect to the original road.

Categorization by project function may be similar, if not identical, to that by the connection circumstance. A toll road project may function as *a congestion reliever*, which often applies to a bypass route, as *a development road*, often applying to a planned network road, or as *a crossing* of a barrier such as river crossing like bridges and tunnels. A congestion reliever or a bypass route may be inexpensive because it tends to be short, but may be expensive because it often requires expensive right-of-way. Development roads are often speculative from the economic viewpoint, and bridges and tunnels usually cost so much that they demand heavy traffic volume to be feasible. **Table 5-3** shows the types of toll road projects described in Chapter 4.

Table 5-3 Types of Toll Road Projects

		Contract Type			
		New construction	Rebuilding or expanding*[2]		O&M only
			Tolled	Free	
Network Circumstance*[1]	Planned network	Current major projects in Japan, HW407		DBFO roads in U.K.	DBFO roads in U.K.
	Brand-new route competing with free route (Bypass route)	SR57*[3], DBFO roads in U.K.		SR91	
	Independent new bridge or tunnel (water crossing, etc.)	Confederation, Sydney Harbour, HSBA, Tokyo Bay Aqua-Line			

*[1] Every project listed in the table can fall into the congestion relievers category. But some may be development roads (Confederation, DBFO, TTB), and of course, the Confederation and the Sydney Harbour are crossings as well as Japan's Tokyo Bay Aqua-Line and HSBA projects.

*[2] Rebuilding or expanding projects can be divided into two segments dependent on whether the original road is tolled or free.

*[3] The SR57 project was actually planned as an expanding project, but as the alignment was not relevant to the existing one, it is put in the new construction cell.

5.2.3. The Prospects for Private Toll Road System

Gomez-Ibanez and Meyer[16] raise four factors on which the feasibility of toll road systems depends: 1) prospective toll road builders must find a situation where the public will accept tolls, 2) the revenue from the road must be sufficient to cover all or most of the construction and operating costs, 3) the environmental and other external costs the road imposes on neighboring communities must be acceptable or reasonable, and 4) the question of market or monopoly power and its effects on economic viability and political acceptance must be well resolved. Although they focus on toll roads in the U.S., the factors are applicable to anywhere else.

[16] Gomez-Ibanez and Meyer (1991): "Private Toll Roads in the United States, The Early Experience of Virginia and California," *Harvard University Report*

Fisher and Babbar[17] assess ten international private toll road projects by analyzing their functions, physical characteristics and project costs, market demands, concession policy and process environments, economic and political contexts, and local capital markets. While prospective PFI toll road projects in Japan would be indeed different from international ones in a range of aspects, the foregoing aspects should be considered in developing a private toll road framework.

This subsection examines the prospects for a private toll road system using the PFI scheme in Japan with the following four thresholds: 1) necessity and policy environment, 2) political and economic viability, 3) financial feasibility, and 4) environmental and social viability.

(1) Necessity and Policy Environment in Japan

Highway infrastructure has been traditionally funded by the public sector both in Japan and in other countries often through earmarked taxes such as gasoline tax and motor vehicle tax. As the country grew and developed, the publicly funded free highways have suffered from excess traffic volume and the necessity of other financing schemes to develop a more sophisticated highway network. Following these trends, many countries, Japan included, have adopted the toll road system, public or private. However, the toll road system alone has not been sufficient in a growing economy even though the construction costs financed by debts have been repaid by tolls the users pay. The private toll road system has thus been expected to facilitate the growing demand, together with government deficits to finance toll road projects on both the national and local levels. Other factors in favor of the private tolling system are: the worldwide trend toward commercialization and privatization of publicly owned enterprises; the success of public toll roads in raising capital; and advances in tolling technology, making tolling more efficient and convenient.

The standpoint of continuity, not of short-term boosting, should be considered in evaluating potential project developments. In the Japanese PFI, as in other nations or other public facilities, successful establishment in preliminary toll road projects is quite important to continuously implement toll road projects with the PFI scheme. Fortunately

[17] Fisher and Babbar (1996): "Private Financing of Toll Roads," *RMC Discussion Paper Series* 117, World Bank

for PFI toll road facilitators, Japanese PFI projects have already been launched in other areas such as public colleges, offices, waste treatment plants, and so on. These experiences can serve as lessons for implementing PFI toll road projects. Although the government, or MLIT, has been cautious about implementing any type of projects, should it once initiate a PFI scheme, the model would serve as a template for future projects.

However, the overall policy environment in Japan is not favorable enough to convince policy makers that a PFI toll road scheme can be introduced without difficulties. Compared to California's AB680, for example, Japan has no private toll-road-specific legislation or any other experiences, or reasonable evaluation criteria for the concession, either. These potential problems must be solved with strong incentives of the government in implementing private toll road projects.

(2) Political and Economic Viability

Potential Opposition from Citizens. Environmentalists, community activists and others may strongly oppose any types of road projects, which need a physically long piece of land for the alignment. There are actually a number of suspended road plans in Japan, which cannot be advanced due to such strong opposition and the government's reluctance to exercise eminent domain. If a project is planned in the sea, as is the case of a bridge or tunnel project, such as Honshu-Shikoku Bridges and Tokyo Bay Aqua-Line, fishing rights become another difficult issue. The local fishermen's association almost always has strong contrary emotions and require more than equitable compensations. Right-of-way acquisition or fishing rights compensation may be the most crucial factor for toll road implementation, whether or not implemented as a Japanese PFI, which must be resolved by partnership between the public and private sectors. That is to say, the public sector can provide the protestors with credibility not to walk away in any event, while the private sector generally has much stronger incentives for early solution of problems to commence the operation earlier to generate a revenue stream.

Capital Market in Japan. Capital Market in Japan is one of the most stable and sophisticated markets in the world, and therefore, the government can easily, and with favorable terms and conditions, raise initial funds from the capital markets, for instance, by issuing construction government bonds or some other forms despite the extraordinary

amount of debt outstanding attributed to the national and local governments combined: ¥666 trillion in 2001, which would be 1.3 times as large as its Gross Domestic Product. Recent interest rates in Japan are significantly low compared to other nations, and represented as follows: 1.1-1.9% for 10-year term government bonds, 2.1-2.5% for 20-year term government bonds, and 2.4-2.9% for 30-year term government bonds. However, when considering private financing, the Japanese capital market is not necessarily favorable for a private project company because of the lack of individuals' appetite of investment. Financial aspects for the desirable PFI toll road scheme are suggested in the last section of this chapter.

Monopoly, Competition and Regulation. Protecting the private operator from excessive competition with other free or tolled roads (so that producing profits is possible) and protecting the public from the potential abuses of a monopoly franchise (in the form of high toll rates or limits on capacity) must be balanced. If the public agency protects the private sector excessively, a monopoly situation of the private entity may occur. If the public agency oversees the private sector too intensely, the private entity may not produce sufficient profits because it may have the aftereffects of the severe competition experience at the beginning of the project. Well-balanced public-private partnership may be requested, but moreover, the appropriate government's incentive would be necessary for this issue.

The government and the private project company can establish a scheme that takes the issue into account. For example, California's Department of Transportation (Caltrans) set equitable rates-of-return of 17-21.5% plus incentives on the four AB680 projects.[18] Toll rate range was the main determinant in British DBFO road projects, while in the Confederation Bridge case and the Sydney Harbour Tunnel case, the maximum toll rates were bound to the CPI indexes. In most of the cases studied, safety and performance level of the road are constantly monitored or overseen by the government. Finally, exclusivity, or a non-competitive clause, is included in California cases, in the Confederation Bridge case, and in others.

[18] Also, Virginia DOT set 14% as maximum rate-of-return for Dulles Toll Road Extension project.

(3) Financial Feasibility

Factors for Financial Feasibility

Factors to consider for the financial feasibility of a project are pre-construction cost, design and construction cost, operation and maintenance cost, financing cost, and the cost to assume the risks involved. *Pre-construction cost* includes proposal documents preparation cost, investigation cost for the site condition and specification requirements, consultant fees for legal, financial, and technical advisors, permission and approval processing fees, administrative costs, and so on. Characteristic features in this stage are that the traffic study affects so much of the project economics that the study is crucial and that the site investigation is very costly because of the lengthy alignment for a toll road or the construction difficulty for a bridge or tunnel. *Design and construction cost* is obviously for the design and construction of the project. For a complicated project with complicated site conditions such as restricted construction work space or time in a congested urban area or uncertain soil profile under water for a bridge project, design and construction cost can increase or decrease significantly. *Operation and maintenance cost* depends on the system design and the initial specifications for the construction. More and more importance has been put on life-cycle engineering in Japan, as well as other industrial countries, justifying heavier initial investment to reduce later, recurring burdens. ITS (Intelligent Transportation Systems) such as ETC (Electric Toll Collection) may also greatly influence the cost. *Financing cost* pertains to who lends the money and to whom or which project. Public financing such as bond issuance needs the investment rate of the project or the project company, or the sponsor, to determine the risk premium, which can be assumed as the exact financing cost. Financial institutions examine the risk profile and the profitability of the project in most cases when private financing is applicable. Private project companies must pay much more for the financing than the public sector. *The cost to assume the risks* is in large part included in the financing cost, but other forms of the cost may be paying insurance premiums and investing in a capital market such as derivatives to hedge financial and economic risks.

Project Function and Financial Feasibility.

Project function is one of the key factors that influence the financial feasibility of a toll road/bridge/tunnel project. "Congestion relieving road" projects are likely to

involve high land prices and compensation costs for the existing pertinent communities that would be deteriorated by the project and face competition with the existing network, which was built on the least costly alignments by public agencies, such as Japan Highway or Metropolitan Express Public Corporation. But the most important factor, toll revenue stream, is likely to be favorable for congestion relievers. "Development roads" have the disadvantage of facing a slow and uncertain traffic build-up and the advantage of less costly alignment in general. In Japan, however, alignments of development roads are likely to be in mountainous or narrow shoreline terrains and thus expensive tunnels and bridges would be necessary. "Crossings," or bridges and tunnels, require very expensive construction cost, but the toll revenue may be sufficient to reimburse the cost. If an MCF can achieve the innovation in construction and attain drastic design and construction cost reduction, which is most possible in bridge/tunnel projects, financial feasibility could be attained.

Government Assistance.

Government assistance is a crucial issue for the success of toll road/bridge/tunnel projects in Japan, where, like other nations, relatively profitable projects have already been done by the public sector. Government assistance can be accepted in a variety of forms in almost every stage of the project, and sometimes the assistance is essential to implement the project. For example, in order to give concession rights, the government may have to first establish or amend some laws or ordinances, which may not suppose any types of potential projects. The PFI Act in Japan is the striking example of this movement and is reportedly regarded sufficient to release a private toll road project. The government may give a project company financial assistance directly or indirectly. The shadow toll system adopted in the U.K. and subsidies as in the Confederation Bridge project are examples of direct government assistance, while guarantees and government risk sharing are examples of indirect assistance. Government financial supports are described and suggested in Section 5.4 in detail.

Private Sector's Efficiency.

Even if a private entity finds an equitable project as a toll road, it can be procured by the public sector as well with the traditional DBB delivery method, so the PFI requires the private sector's victory over the public sector, where efficiencies of the project should

be measured and achieved by the private procurement. It is generally recognized that the private sector is more efficient than the public sector because of the profit-seeking feature of the private sector. For instance, the U.K.'s Highway Agency estimated 15% cost savings compared to the public sector comparators, although the National Audit Office claimed that the figure (15%) was overstated in part. (See Section 4.2.8.) A number of privatization experiences in various engineering/construction fields also show proof of the private sector's efficiency. On the other hand, Japan's public sector, represented by its bureaucratic system with enormous authority, is also changing its culture and moving toward efficient operations and works. For example, public involvement and accountability have been respected more than ever, and the Information Disclosure Law, by which the government must disclose substantial information and data to the public, has become effective since April 1, 2001. Personnel evaluation based on the bureaucrat's capability and achievement, rather than the conventional seniority system, is being considered as a "reform of civil service system" plan even in the public sector, where the strict seniority system has been effective. If this reform works, the public sector should have much more efficiency in the near future, which might become a threat for the private sector, who must compete with them.

(4) Environmental and Social Viability

Public Acceptance of Tolls.

Public acceptance of a toll road project implies that people expect both the toll and process for determining government funding priorities, if any, to be fair (Gomez-Ibanez and Meyer, 1991). In addition, many assume that collecting tolls as well as levying earmarked fuel and other vehicle excise taxes represents "double taxation." Japan's cases are favorable in this regard because the toll road system has been widely disseminated for almost forty years, and there are also some small-scale private toll roads for sightseeing businesses, so toll road users are used to paying tolls without hesitation.

Externalities: The Environment, Growth Management, and Eminent Domain.

Toll roads, of any types or functions, are surrounded by externalities such as environmental, growth management, and eminent domain issues, which the project company cannot solve by itself. For example, growth management needs the perspective

of regional development, which relates to spin-off effects of the project. The private sector may or may not handle the matters well because private companies have flexibility and incentive not to delay, while they are more sensitive to the costs. Citizens are likely to suspect that the private company may cut corners for profits. In terms of eminent domain, the private sector would avoid situations of eminent domain as much as possible with a different reason from that of the public sector. The private sector would simply try to shorten the total duration from the pre-construction to the commencement because they know the effect of the time and try to do better scheduling management. On the other hand, the governments may hesitate to exercise the eminent domain because most of them assume it is the last alternative, which should be avoided not to seriously conflict with pertinent parties. However, the consequence is that countless projects are suspended thanks to the opposition parties along the alignment.

Externalities are relevant to the function of the toll road project. Environmental concerns, for instance, ensue most often in development roads, although the other types may also face the issue, while in crossing projects, growth management is significant and eminent domain has less impact than development roads or congestion relievers.

5.3. Advantages and Disadvantages of the PFI for Toll roads/bridges/tunnels

If Japanese PFI toll roads are feasible, does the private procurement really have the advantage over the public? This section examines characteristics of the Japanese PFI applied to toll road/bridge/tunnel projects by comparing them with other projects, focusing on public versus private and the MCF's workplace. Because there is no direct comparison project in Japan delivered by the Japanese PFI scheme, it is essential to look at the prospective framework for the Japanese toll roads projects from the standpoints of several other projects that have common conditions in most regards: traditional public-managing toll road projects in Japan; privatized public infrastructure projects other than toll roads in Japan, such as railroad and power projects; pioneer Japanese PFI projects, such as buildings and power plants; and BOT or DBFO toll road projects overseas, all of which are examined in Chapter 4.

5.3.1. Advantages of the PFI Scheme

(1) Necessity of Private Finance

If the public has sufficient sources of funds to construct and maintain toll roads, for instance, earmarked taxes or Treasury Loans and Investments (funded by government operating businesses such as Postal Savings and Postal Life Insurance), the public toll roads may have advantages for financing costs. If not, there is the necessity of private finance if a toll road project is feasible. Japan's current economic environment has been changing from the public finance initiative to restraints on spending public money, especially for public works, even though the fiscal reformation policy has been given a grace period for these three years or so. Without private financing, not only planned highway networks but also other necessary potential toll roads, such as congestion relievers and crossing projects, would undoubtedly slow down. The Japanese PFI was introduced in this circumstance in part because less initial financial burden to the public sector was necessary. This necessity is the greatest advantage of private financing.

(2) Efficiency Advantages over the Public Alternatives

Section 5.2.3 mentions efficiency to be as a factor of the feasibility of a PFI toll road project, and the private sector is assumed more efficient because of its profit-seeking feature. Here are more concrete evidences of the private sector's efficiency.

Involvement in planning and design stages

Private sector involvement in planning and design stages gives both the public and private sectors great opportunities to achieve better value for money. As shown in JR and TEPCO cases in Chapter 4, where MCFs often propose more efficient or less expensive design and construction alternatives with good incentives, the private owners take advantage of private sector efficiencies. Since Japanese MCFs have competitive technologies and expertise in a wide range of areas, including materials, environmental regulations, advanced design technique, operational knowledge, various construction equipment, and numerous experiences, when they are given broader and flexible scope, it is likely to achieve more efficient construction and operation.[19] All of the foreign toll road examples studied in Chapter 4, including California's extreme cases, sought to cultivate this private sector's (the MCFs') advantage, and, in general, have succeeded.

Efficient Management

As opposed to public personnel, who are expected to deliver a public facility without problems but with limited responsibilities during their short-term position, private personnel are encouraged to manage the project efficiently for profits. This difference gives the private sector the advantage of efficiency. Life cycle engineering, scale merit, and cost and time reductions are among the examples of this benefit.

Life cycle engineering considers the overall efficiency throughout the facility's lifetime, usually more than the concession period such as thirty years in toll road/bridge/tunnel cases. As is the case of Japan's public procurement, if design, construction, and operation are delivered separately, construction cost should be minimized because it is the first crucial cost factor of the project within a narrow scope, and life cycle cost cannot be assessed.

[19] MLIT is currently examining the viability of "Design-Build Package" in a special committee and has found its effectiveness.

Scale merit represents the capability of efficient management that stems from the larger scale or scope of the project, such as utilization of technical skills, personnel, materials, and resources and innovation encouragement. For example, a major public project in Japan such as the Kurushima Kaikyo Bridge or Tokyo Bay Aqua-Line has been divided into dozens of construction contracts even if many of the contractors may use the same sub-contractors or techniques in large portions. On the contrary, in every foreign example shown in Chapter 4 delivered by the private sector, the contracts went to a single consortium, and the consortium has exercised its best efficiencies. The PFI is the only delivery system for now in Japan to best utilize the private sector's scale merit.

Cost and time reductions are widely recognized as the private sector's advantage. With the PFI, the project company must generate a revenue stream by tolls from the road users as early as possible and must minimize the construction cost so that the company can repay the debts in full and generate net profits as early as possible. These incentives work less for the public sector, and potentials for early operation are enormous for the private sector. For instance, in the Confederation Bridge project, the MCFs completed the construction work in only 42 months, whereas the bridge portion of the Tokyo Bay Aqua-Line took more than 7 years for a similar structure of much shorter length; and in the Route 3 North project in the suburban Boston, although not described in Chapter 4, the project company is supposed to finish the construction also in 42 months with design-build utilization, while the public-planned original schedule indicated that it would take some two years more.

Less Political Restraint

There are a variety of political restraints for the public sector procurement, explicitly or implicitly, in each stage of the delivery. In use of labor and equipment, for example, the government intervenes in the selection process of a pure private company to reflect a politician's power related to a specific subcontractor or an equipment supplier. Even among the trend towards the performance specification, the public sector may have to stick to a traditional, obsolete specification, which some industry-related political power insists on retaining. The private sector can be released from these political restraints and therefore has the advantage over the public sector. As for the operation, moreover, more innovative facility designs or operating schemes can be adopted; for

instance, the private sector may design for the exclusive use of lightweight vehicles to reduce the surcharge requirement, which drastically influences the overall structure, and costs, of roads/bridges/tunnels.

Overall Evaluation Competitive Bidding System (Utilization of MCF's capability)

The Japanese PFI assumes "the Overall Evaluation Competitive Bidding System" as a standard. Experiences described in Chapter 4, the JR and TEPCO cases, show its advantages. The MLIT, at the national level, has actually started to try adopting "the Overall Evaluation Competitive Bidding System" for only two projects so far and recognized its effectiveness; however, the move is slow because it requires special legislation for each single project.

(3) Technological Innovation as the Outcome of the PFI

Some would argue that in the PFI, because the investors would avoid risks arising from the adoption of a technological innovation and thus they would like safe techniques, technological innovation, which must bear more expensive risk premiums, is not likely to occur. This may be true if the risk is transferred to the investors to a substantial extent, or if the improvement by the innovation is not considerable enough. Experiences, however, show different views.

"PFI is the perfect framework for the introduction of the innovation," claimed Michael Perry, former official advisor to both Australian and British PFI projects. [20] It is important to understand that the government does not have the role to prescribe the means to achieve a project, financially, commercially, or technically, but only outcomes of the project. There are plenty of cases where technological innovations were introduced. For example, HW407 adopted an elaborate Electric Toll Collection system, the Sydney Harbour Tunnel solved the difficult issue of how to ventilate the exhaust gas, and an innovative foundation structure was designed for the Confederation Bridge.

Even though a tremendous number of innovations have been accomplished with the traditional delivery system in Japan, as in the Honshu-Shikoku Bridge projects and Tokyo Bay Aqua-Line projects[21], those types of innovation procedures, i.e., without

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[20] Japan Project-Industry Council (1998): Eikoku oyobi Osutoraria no PFI jigyo ni okeru Seifu to Minkan Jigyosha tono Kankei ni tsuite (Public-Private Relationship in British and Australian PFI Projects), JAPIC

[21] See Chapters 2 & 4.

equitable compensation for the cooperation of MCFs, may not be justified in the future Japanese construction industry, where transparent, accountable public-private collaboration is required.

(4) Value for Money by the Japanese PFI

Value for money (VFM) is the ultimate objective of the PFI, but contains various elements that cannot be measured directly or easily into cost or benefit figures. The following items are among such elements.

Evaluation of externality. "Externality" here means external economic effects produced by the PFI project, such as development benefits for the neighboring communities and economies. If externality can be evaluated as a benefit of the PFI project, and if eventually the project company can take into account the benefit as the revenue of the project, VFM of the PFI project would improve. For example, most of the Japanese private railway companies run the development business along their alignment, which is an important revenue source of the groups. However, since the PFI intends to promote public facilities implementation, indirect development should be strictly separated so that the risks involved in the development project would be allocated to neither the project company nor the public. It is expected that if the project has substantial potential to produce development benefits, especially for the general public, some subsidy equitable for the benefits will be established.

Valuation of services. The service level can be improved by the PFI if it is fairly valuated so that the project company has enough incentives to improve the services, such as maintenance frequency, overall congestion level, availability of the emergency services, and the comfort level of the roads. Caltrans has given the project company the incentive in a form of additional rates of return the company could earn from the project according to the level of safety and availability of the road in the SR91 project.

Reasonable and Fair Risk-Return allocation. When the project company seeks the most profitable scheme of the risk allocation and the public agency seeks the best VFM of the project, risks involved in the project must be allocated to whomever could manage them best because otherwise the project bears the risk premium for the risk. Although risks may tend to transfer to the private sector in the PFI as in U.K.'s DBFO

roads, Japan's PFI Basic Policies strictly encourage that the implementation policy of each potential project should include the description of the risk allocation plan. Both the public agency and the prospective private company shall begin the negotiation with the provided plan and try to minimize the project costs for both. It is better for citizens, who have been used to looking at their taxes spent for something they do not have opportunities to check the outcome of, at least to see the rules of when and for what the taxes would be spent.

Additional Investment Opportunity. According to the articles from several Japanese newspapers, there are ¥1,200 trillion worth of private entities' financial assets, which tend to be invested in foreign capital market, and ¥1,400 trillion worth of personal financial assets, which cannot be invested in any financial market, in Japan. Private entities are seeking for proper investment opportunities, while individuals do not have incentives to invest, in part because Japanese are pessimistic about their future as the social security system does not seem stable with the rapidly aging population, and in part because Japan's structural reformation is not proceeding. The PFI project may be one in which financial institutions, for example, have the opportunity to invest to diverse their portfolios, or to mitigate their corporate risks. Issuing revenue bonds for a toll road/bridge/tunnel project to neighboring individuals or institutions who await the project, for instance, may be a good idea to stimulate necessary investments.

Early Operation Effects. If the construction duration is shortened, relevant economic activities such as development projects along the alignment would begin earlier, and then the synergy effect would bring about better value for money of the PFI project, in addition to the direct effect to the profitability of the project. However, the right-of-way problem often arises in implementing the road-type project. It is desirable to establish some measures to facilitate the acquisition of the right-of-way, as well as to standardize the forms of the PFI contract documents.[22]

Encouragement. The main contribution of potential PFI toll roads is probably their willingness to be more innovative, or the PFI is more willing to explore new technologies and techniques. What is important behind these contributions is that the PFI

[22] Miyamoto, Kazuaki (1999): "Prospects and Concerns of the Introduction of the Japanese PFI," *Journal of the Japan Society of Civil Engineers*, Vol.84

encourages more efficient, innovative alternative procurement of the public sector, or the national and local government agencies.

5.3.2. Disadvantages of the PFI Scheme

Private Company's Profit

The private project company needs profits, or return on investment, from the revenue of the toll road/bridge/tunnel project by definition, while the public sector does not. Therefore, the public sector would have the advantage of less expensive procurement of the project over the private sector, other things being equal. For example, if the required rate of return on investment of the project company is 20% and if the company's debt-to-equity ratio is 4.0, then the project company needs profit margin of 4% (=1/ (1+4.0)*20%) of the total assets for the investors every year, while in the public sector project, the profit amount might go to some public funds, be used to lower the tolls, or have already reduced the project cost with less initial use of the taxes if any, other things being equal. The private sector should overcome this disadvantage by structuring more efficient project scheme.

Expensive Financing Cost

Financing costs are no doubt more expensive for the private project company than for the public agencies. Financing costs, for long-term, large amount financing, represents the interest the borrower has to repay with the capital, which reflects the level of risks or uncertainties involved in the project and the risk allocation structure. Financing for a PFI project is assumed "project financing," which is meant investment in the project, not in a company, with collateral of only the assets and the cash flow stream of the project. Therefore, in project financing, there needs to be plenty of information and sound evaluation of the project feasibility and profitability as well as of organizational structure and the capability of the consortia to pursue the project. Financing issue is a complicated in part because project finance has been introduced only for two years in Japan and because long-term financing, such as more than 15-year term, is rare in the financial market.

When the experiences accumulate and the long-term financing market is developed, the emergence of a PFI bond market may be plausible. Mezzanine capital, for instance, is desirable for the financially standing-alone projects to reduce the financial burden of the sponsors and to share the demand risks in the future. It may drastically encourage potential sponsors' incentives to be involved in PFI projects, and accordingly, stimulate the PFI market further. In the meantime, however, financing with loans is likely to be the main source of PFI projects, with the financial institutions' oversights.

Needs of Government Supports

Types of supports, availability, and experiences are discussed in Section 5.4.2 (4) "Government's Financial Supports" for a framework as to needs of government supports. This is one of the most complicated and crucial issue to implement PFI toll road project in Japan, and the necessity of government supports is literally a disadvantage to the private sector.

Long-term Incentive Issue

It is essential for both the public agency and the private undertaker to keep their motivation for a long term of 20 to 30 years. For the public sector procurement, long-term governmental needs should be tested, rather than adopting the project merely because of a positive VFM. If the long-term necessity is not sufficient, and if the project appears to be no more necessary in the short run, the public agency may be tempted to terminate early. Even if the agreement includes the government's long-term payment permission (e.g., in the case of Shadow Toll scheme), the private undertaker and the financer would not be relieved. This is especially true when the public agency is a local agency with less flexibility in terms of financial capacity.

For the private, the MCF's incentive to participate in the project is greatest before and during the construction phase. The contractor's motivation is to minimize the equity contribution not to be exposed to operation, traffic volume, or financial risks, which are extremely large for the contractor, and to maximize the construction profits. Therefore, once the contractor completes the project, it gains the incentive to walk away from the project to abandon its risk exposure. To reduce the risk of losing the contractor's incentive, requirement of the guarantee from the sponsor, shorter term of the loan than

the concession period, and the financial scheme that regulates late payment from the project may be considered.

Contract Issue (Transparency, Fairness, Complexity, Remaining Uncertainties)

The Public Competitive Bidding system must be adopted in PFI. The Public Competitive Bidding means that the public agency is required to provide precise, final contract documents by the public offering. However, hearing from the private sector for the sophisticated contract documents and making the process transparent and fair seem to be difficult because neither the public nor private sector is yet familiar with construction sites or the contract itself.

Possibility of the Project Company's Default

If the private project company cannot repay the predetermined debt services, the company falls into default, or goes bankrupt, whereas no one generally recognizes that the public company would go bankrupt. In the case of the project company's default, as the project is worth nothing unless someone operates it, the lenders should make the best effort to cooperate with sponsor companies and to keep the toll road open so that the road generates some cash flow. To make this effort possible, it is required in the Basic Policies of the Japanese PFI that the project agreement stipulate that the financial institutions can take over the project, with direct agreement between the public agency and the financial institution. Nonetheless, the default risk remains for PFI projects and the possibility is a disadvantage to the PFI.

5.4. A PFI Framework for Toll road/Bridge/Tunnel Projects

To establish a framework proposal for PFI toll road/bridge/tunnel projects, this section first summarize the advantages and disadvantages for each type of toll road project, regarding the discussions in foregoing sections of this chapter. Then, the proposal refers to a prospective organizational structure and several elements the framework should cover.

5.4.1. Viable Types for Successful PFI Toll road Projects

(1) Advantages and Disadvantages for Each Type of Toll road Project

The advantages and disadvantages for each type of toll road project, regarding the discussions in foregoing sections of this chapter, can be summarized in **Table 5-3**, although the evaluations in the table include some ambiguity and should vary from project to project to a substantial extent even if some projects fall into the same column. In this table, "feasibility" evaluations are based on the perspective of a toll road project, whether public or private, while "advantages" and "disadvantages" are evaluated by the comparison between the public procurement and the private development, or the Japanese PFI as well as by the comparison between the project types. Favorable projects as a PFI, rather than unfavorable ones, are assumed in each evaluation. The factors to be evaluated are arranged from the foregoing sections.

A new construction project of bridges/tunnels, for instance, which is usually complicated and large, has moderate advantages in some of the feasibility factors and larger potential advantages, compared to the others, in advantage factors such as "efficient planning and design" which would bring about huge construction cost reduction. However, financial feasibility, in particular, depends largely on the potential project, that is, predicted traffic volume and the certainty of the prediction as well as other factors such as completeness of the connecting network with the bridge/tunnel. Therefore, despite the evaluation of "somewhat advantageous" in financial feasibility, some potential projects may fall into "not feasible at all."

Table 5-4 Types of Projects and their Potential Feasibility as Toll roads and (Dis)Advantages as a PFI

	Contract Type	New Construction				Rebuilding			O&M	
	Function	B/T*[1]	Bypass		Develop	B/T, Bypass		Develop	Develop	B/T, B
	Technical Complicatedness	Compli-cated	Compli-cated	Normal	Compl./ Normal	Compli-cated	Normal	Compl./ Normal	Normal	Normal
	Assumed Project Scale	Large	>	>	>	Moderate	>	>	>	Small
Feasibility*	Necessity and Policy Environ't	△			▲			▲	○	○
	Political and Economic	△			▲				○	○
	Financial Feasibility*[2]	△	△	○		△	○		△	△
	Environmental, Social Viability		▲	▲	●				○	○
Advantages*	Necessity of Private Finance	○	○	○	△	△	△	△		
	Efficient Plann ing and Design	○	○			△				
	Scale Merit	○	○	○	△	△	△	△		
	Less political restraint	△	△	△	○	△	△	△		
	Technological Innovation	○	○			△				
	External Effects	○	△	△	○	△	△	△		
	Reasonable Risk Allocation	△	△	△	△	△	△	△	△	△
	Additional Investment	○	○	△		△				
	Early Operatio Effect	○	○	○		△	△	△		
Disadvantages*	Private Co.'s Profit	●	●	●	▲	▲	▲	▲	▲	▲
	Expensive Financing Cost	●	●	▲	▲	●	▲	▲	▲	▲
	Needs of Gov't Supports	▲	▲		●	▲				
	Long-term Incentive	▲	▲	▲	▲	▲	▲	▲		
	Contract Issues	▲	▲	▲	▲	▲	▲	▲	▲	▲
	Overall Advantage*[3]	○	○	△	△	△	△			

* ○: Feasible/Advantageous, △: Somewhat F/A, ●: Infeasible/Disadvantageous, ▲: Somewhat I/D
Bolded, gray rows represent high priority.
Evaluations are assumed for favorable projects as a PFI (against public procurement).
See the text for more explanation.

*[1] B/T: Bridges/Tunnels

*[2] Financial feasibility is largely dependent on predicted traffic volume and the certainty of the prediction.

*[3] Needless to say, overall evaluations must vary project-to-project and depend on future changes in governmental policies, political, economic, and social environment.

Development road projects, on one hand, may have some problems in feasibility such as potential opposition from citizens due to the lack of profitability, the right-of-way acquisition problem with its lengthy alignment, and in policy environment because Japan Highway Public Corporation (JH) has been exclusively developing and operating Japan's highway network, which consists most of the development roads in Japan. On the other hand, since JH's development highways are currently highly regulated, the PFI scheme would realize the advantages of the private sector: political restraints reduction and external effects.

Bypass road projects and rebuilding projects are likely to have the intermediate characteristics between the new construction projects of bridges/tunnels and development roads. It should be noted that technical complicatedness of bridge/tunnel or bypass projects greatly affects both feasibility as a toll road and advantageousness as a PFI over the public procurement. For instance, technically complicated projects would have the serious disadvantage regarding the profitability of the project due to heavy initial investment, whereas the very difficulty would generate huge potential to improve the project in planning, design, and construction with private MCF's capabilities. Although not shown in the table, location of the bypass road project also influences significantly its characteristics with regard to the feasibility and PFI's advantageousness.

Operation and maintenance only projects have advantages in feasibility, but less advantages as the PFI than other types of projects. If efficiency of a project is improved significantly by means of a technological innovation, for example, like ITS utilization, PFI for O&M may be viable.

To evaluate overall advantage, the factors of "efficient planning and design" and "early operation effect" are given higher priority because they influence the overall project profitability more than the others and MCFs can play crucial roles for these factors.

As a result, technically complicated new construction projects of bridges/tunnels or bypasses have great potential to be feasible as Japanese PFI toll road projects. However, the applicability must be limited to the particular cases in which the traffic volume is predictable for reasonably certain and sufficient to overcome larger disadvantages in the company's profits and financing costs, with complete connecting network necessary to generate the traffic on the project route. In addition, they may need

some government supports exemplified in the Section 5.4.2 (4) as elements of the proposed framework. Bridge/tunnel or bypass projects with less technical complicatedness may have the opportunity to be implemented by PFI only when they have some significant advantages over the public procurement. If policy environment changes and considerable government subsidies are likely, a new construction project of a development road, or network highway, may be possible in some cases. Operation and maintenance only projects are less attractive to MCFs.

(2) Types of PFI Toll road/bridge/tunnel Projects for the Framework

Accordingly, from the perspective of the MCF that would manage a PFI project, viable project types are limited to those summarized below:[23]

1) Bridges/Tunnels that require complicated technology so that MCF's innovative approaches would contribute largely to viability of the project,
2) Bypass roads with sufficient toll revenues, and
3) Some network roads under the conditions that governments' financial supports such as utilization of "shadow tolls" are sufficient to the feasibility, policy environment of the toll road system changes, and so on.

Bridges and tunnels tend to be very expensive because of severe challenges in engineering necessary to construct structures in the water or with constraints of geographic or physical barriers. This in return gives MCFs considerable opportunity to challenge the public sector procurement with their capabilities to introduce innovative technologies and integrated creativities. Private financing of major bridges and tunnels appears to be more practicable undoubtedly because the traffic is largely captive, and hence there can be more confidence in the traffic projections. Although involvement of the private sector in concessions for road maintenance and operation has generally been more successful, compared with construction,[24] this thesis will not go further with such projects because the focus is from an MCF's viewpoint. Bypass roads may or may not have quite different profiles, including risk features, and network roads do have different profiles, from bridges/tunnels.

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[23] This list does not mean that every potential project falling into one of the three categories is viable as a PFI project.

[24] Malone, Patrick (1999): "Overview of World Experience in Private Financing in the Road Sector: some principal cases," *The World Bank Working Paper Series*

Figure 5-6 shows a basic concept of the viability of PFI projects, compared to the PSC (Public Sector Comparator), which represents the cost of the project if the public sector procures for a certain level of the project value. To be feasible as a PFI, a prospective project should significantly improve the project value by better risk sharing, innovation, and so on or significantly reduce the cost in spite of higher bidding, financing, and "for profit" costs with the PFI scheme.

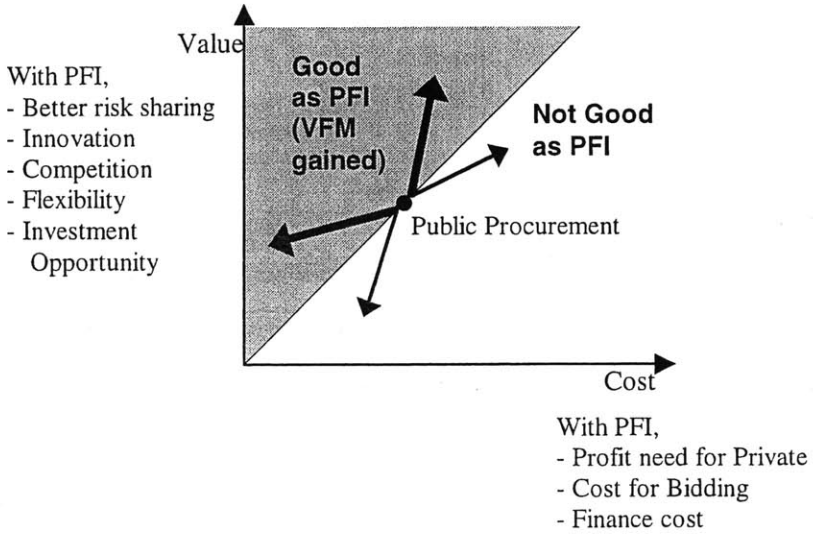

Figure 5-6 Value for Money by PFI

5.4.2. A PFI Framework for Toll roads/Bridges/Tunnels Projects

(1) Organization Framework

Prospective organizational structure may vary, depending on how the project relates to governments and existing operation companies such as Japan Highway Public Corporation (JH) and Metropolitan Expressway Public Corporation (MEPC). Typical organization structures may be as shown in **Figure 5-7**.

In **Figure 5-7**, dashed lines represent an alternative flow of tolls in the case of a project consisting a portion of the network that JH currently manages, where toll revenues should be pooled with other network roads in JH's toll pooling system described in Subsection 5.2.1. In such a case, tolls paid by the users are collected into JH's account, which is used to repay the loans of the construction of the entire network

system, and the project company receives the payment from JH according to the concession agreement with JH or the national government.

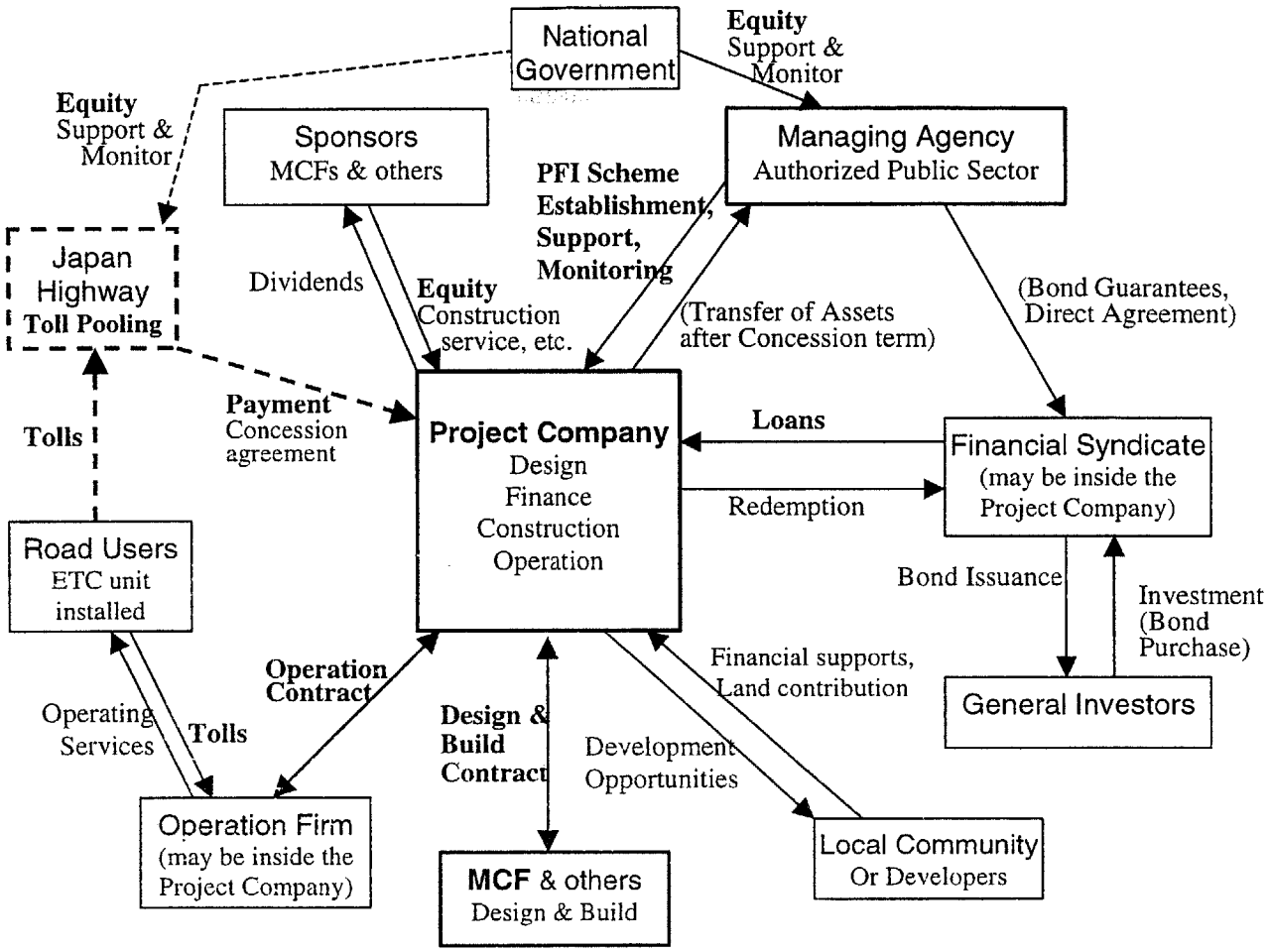

Figure 5-7 Prospective Organization Structure for a PFI Toll road/bridge/tunnel Project

For most independent bridge/tunnel, or bypass projects, tolls can be directly paid to the project company and become the dominant source of the repayment of the loans and bonds the company have borrowed and issued. If the project is profitable enough, and when all the debts are repaid, toll revenues will be used for dividend payments to the investors and sponsors, presumably including MCFs.

Like experiences studied in Chapter 4, the government, national or local level, sponsors, often led by a MCF, and financial institutions are other participants. Financial institutions may be willing to take part as sponsor companies in the project so as to take project risks more aggressively, seeking more return, and control and monitor the project.

The government also plays important roles in various ways discussed shortly, and local community or developers may want to participate in order for their interests.

(2) Project and Undertaker Selections

A PFI toll road project would begin with identifying potential projects. Although the PFI Act encourages the private sector to propose suitable projects as the PFI, it is desirable that the government announces which projects are on their mind as PFI projects so that private entities become more attracted and can focus more on those specific projects. The announcements would also build fair, competitive environment, which is imperative for the PFI. The government should define a narrow enough and broad enough scope so that potential project companies may not waste time and efforts to narrow the possibilities of the project and can exercise their best efforts to utilize the capabilities in developing the project. For instance, the government should provide a couple of alternative alignments and basic performance specifications such as number of lanes and design vehicle speed, but not provide detail specifications such as type of the structures, precise location of foundations (in the cases of bridges), and so on. In the process of the Confederation Bridge project, proposed structures included both bridges and tunnels in the first stage of proposals. This is a good example where the government tried to bring in the private sector's creativity and originality. Caltrans' case, however, seems to have failed to effectively provide a competitive environment because it did not define even the general location of the project, and as a result, potential project companies competed with one another in different playing fields, proposing different projects throughout the state. Consequently, three of the four selected projects have not yet commenced.

In selecting an appropriate PFI project and its private undertaker under the Japanese PFI scheme, it is reasonable to give the private sector the equal opportunity to compete with the public sector, including representing agency such as JH or MEPC. If the competing public agency would have some financial assistance from the government for the sake of social welfare, potential developers could also obtain the same assistance such as government subsidies, access to the public investment funds, and tax exemptions

in the PFI scheme without interfering with management flexibility. The PFI is intended to utilize the private sector's ingenuities and concepts.

In calculating the NPV (Net Present Value) of a PFI project, the discount rate is determined by adding the risk margin to the risk-free rate. The risk-free rate is based on the rate of the governmental long-term bonds, and 2% of the benchmark rate is adopted as the risk margin in many countries that utilizes PFI schemes.[25] The risk margin ideally should be set dependent on the risk profile of the project, but it is too complicated in practice. The discount rate shall be the same between for the PFI model and for the public model (as the public sector comparator) in the project selection stage.

(3) Government's Responsibility

"The extent to which new high performance road developments will be done as private activities depends on the extent to which acceptable public-private partnership can be designed and implemented." (Gomez-Ibanez and Meyer, 1991) Generally acknowledged responsibilities of the government, in part sharing with the private sector, are scope establishment of the project, project and the undertaker selection, right-of-way acquisition, preliminary studies and legislation if needed, project monitoring, and financial support to whatever extent. Government's proactive participation is essential in any successful projects. Government participation, however, involves some tradeoffs: transparency & competitiveness versus flexibility & innovation. The more the government participates, the more transparent and competitive the project structure would be, but the less flexibility and innovativeness the private sector could enjoy in the project development.

Scope Establishment, Project and Undertaker Selection

As noted above, government participation in "precise" scope establishment is important. If the defined scope is narrowed, the potential project would become more attractive to the private, and narrowed scope is necessary for more efficient, competitive project seeking, but on the other hand, the private sector would become less flexible to identify an innovative project with more developmental risks. In the targeted projects in this section, bridge/tunnel projects need more flexibility for the private sector to exploit

[25] Japan Project-Industry Council (1998). Eikoku oyobi Osutoraria no PFI jigyo ni okeru Seifu to Minkan Jigyosha tono Kankei ni tsuite (Public-Private Relationship in British and Australian PFI Projects), JAPIC

innovative proposals, while network road projects would have narrower scope to be consistent with the network road system. The concept is shown in **Figure 5-8**.

With the traditional delivery system in Japan, the competitive bidding was limited to the construction of strictly defined works with various regulatory frameworks, such as designated bidding system, joint venture requirements, over-divided scopes, designated construction means, and prioritizing local contractors, described mostly in Chapter 2. The PFI induces the developer not only to design and build but also to maintain and operate the project. This overall scope in a flexible, spontaneous proposal can bring about more efficiency, or operational risk reduction, of the project. Therefore, in implementing a PFI toll road project in Japan, stress should be put more on broader scopes rather than narrow ones.

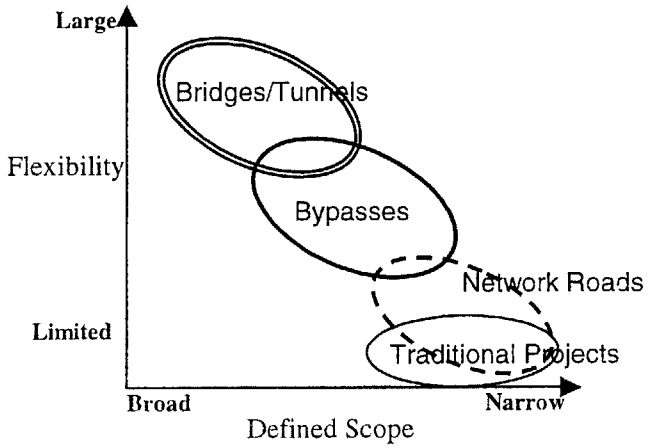

Figure 5-8 Project Type and Government Scope

Preliminary Studies and Legislation

Government assistance during development stage should be considered to demonstrate government commitment and attract potential private entities. Environmental assessment, revenue and traffic study, and local permits and agreement are the areas of preliminary studies. These studies should be cooperatively pursued with the partnership between the public and private sectors. The public sector is likely to have more and better access to resources and information of those issues, while the private sector has more willingness to complete these studies earlier and more accurately. Hence, the joint participation would generate synergy effects for the studies. This process is

usually the key of early operation as seen in most of the cases introduced in the previous chapter.

Legislation, however, cannot be the matter of the private sector, even though it would critically effect the implementation of the project. The government is solely in charge of legislation establishment that facilitates the implementation of the PFI toll road projects, and the government encouragement is definitely necessary for efficient competitions and implementations, although there is no legal obstacle to overcome in order to implement a PFI toll road project.

Right-of-way Acquisition

Responsibility for the right-of-way acquisition should be assumed mainly by the public because they have long, ample experiences of this business, but in part assumed by the private sector. The public sector should pay the acquisition costs, but delay costs should be shared in half between the public and private sectors. So, the private, in nature, try to resolve the right-of-way problems in earnest and it is important. Also, the people in concern expect the public sector's participation to this issue, because the public officials are more credible (for the public sector will not walk away after any events in general).

In case of bridge projects, this discussion would apply to the fishing rights of local fishermen's union.

Project Monitoring

Project monitoring is necessary to protect taxpayers and road users from default of the project company and abuse of the monopoly situation. The project company's performance and activities should be monitored according to the predetermined procedure in the agreement, and the financial status is also confirmed periodically.

However, too much regulation of continuing oversight of the private business may not be necessary, or even worsen, for a toll road project unless the project falls in a serious problem because the regulations may discourage innovation or improvement efforts for more efficient performance.

(4) Governments' Financial Supports

As mentioned earlier, government assistance is a crucial issue for the success of toll road/bridge/tunnel projects in Japan, where, like other nations, relatively profitable

projects have been already done by the public sector or are under management of special public agencies such as JH and MEPC. The Japanese PFI Act specifies some features about direct and indirect government supports. Making full use of the opportunity is desirable for the PFI implementation from the viewpoint of potential project companies such as MCFs. Relevant clauses include the following:

- Debt Payment of the National Government: The national government may pay for debt of a project for no more than 30 years. (Intended to apply to "services sold to the public sector" and "joint ventures" type projects[26], Can be used for shadow tolls or availability fees)
- Non-interest Lending: The national government may lend money with no interest from the budget. It may utilize a governmental financial institution such as the Development Bank of Japan.
- Reservation of Funds and Consideration of Local Bonds
- Use of Public Land for Free of Charge: The national or local government may lend public land for free or at a lower price than the market price.
- Consideration of Acquisition
- Other Supports: The national and the local governments shall provide the legal and taxation support and the financial and monetary assistance as needed.

Levels of supports depend on the project profitability and the public necessity as social welfare. For example, 11,500 km network roads are intended to provide any local citizens with the proximity to a highway, or a trunk road of the network. In these projects, for the public interest, governments' financial supports may be applied to a substantial extent.

Nevertheless, governments' financial supports should be limited such that the supports would make the project most efficient from the viewpoint of the public sector, or taxpayers. Governments' financial supports include equity investment, guarantees, subordinated loans, subsidies (grants), shadow tolls, minimum traffic or revenue guarantee, and other minor supports such as concession extension and exclusivity agreement.

[26] The PFI is divided into three types: services sold to the public sector, financially free standing projects, and joint ventures. See Section 2.3.3.

Equity investment means that the project is "the third sector" project as in the Tokyo Bay Aqua-Line project, in which the public sector contributes equity to the project company and gains return on investment just like the private sponsors. The PFI does not intend to establish this type of public-private partnership, and equity investment is not specified in the Act because this financial instrument not only expose the public sector to the entire project risk but also significantly reduces the incentives of the private sector.

Guarantees include equity guarantees, debt guarantees, and, if financed with foreign currencies, exchange rate guarantees. When the project falls into arrears in its debt service (in the cases of debt guarantees) or falls to the minimum return on investment (in the cases of equity guarantees), the government must furnish the payment to the lenders under the term of this financial support. Government guarantees are the most attractive for the project finance because the project risk is all transferred to the government, and lenders can finance the project with almost no risk. However, governments' financial exposure to risks is the highest in turn among the instruments, and the incentives of the private sector would be reduced. This is why the PFI Act does not suppose government guarantees as well as equity investment.

Subordinated loans are almost always desirable for PFI projects when there is an important gap between senior loans and equity in the project's financial structure. They provide the impact of ability to raise finance of the project without substantial exposure of the government to the project risks. Moreover, since subordinated loans will be repaid before returns on equity if the project turns out to be feasible, they will not only furnish the return to the public but also remain incentives of the project company.

Grants, shadow tolls, and minimum traffic or revenue guarantee, also called *subsidies,* are all financial instruments that do not require repayment. They vary on when and what basis the subsidies will be paid. Grants are one-time, up-front payment instruments, which have larger impact on attracting finance than others, while shadow tolls will be paid periodically (such as monthly) according to the actual traffic volume; and with a minimum traffic or revenue guarantee scheme, the government will subsidize the project only when the actual cash flow falls below a predetermined minimum floor level. The subsidy adopted in the Confederation Bridge project is the fixed annual payment, indexed to the CPI (consumer price index).

Shadow tolls have been adopted in DBFO roads in the U.K. without "real" tolls. The shadow tolls are set such that the more the actual traffic volume, the less the marginal tolls, so the scheme protects the government from the exposure to unlimited obligation if the project is more than successful. Shadow tolls arrangement is useful to support a project's feasibility without heavy financial burden to the government upfront. However, it may not efficiently work if the traffic volume is lower than expected since the lower the traffic volume, the less the amount of the financial support. Therefore, this instrument should be utilized for the projects that are expected to yeild at least medium level of traffic volume such as bridges/tunnels and bypass roads, or coupled with other instruments such as grants and subordinate loans in cases of network roads.

Minimum traffic or revenue guarantee is an attractive means for MCFs in particular if the MCFs want to hedge traffic volume risk as shown in **Figure 5-9**. It is reasonable to set the ceiling together, or the maximum traffic or revenue level, to compensate for the government's risk sharing. This instrument should not be used as a financing tool but as an optional tool only for a risk allocation.

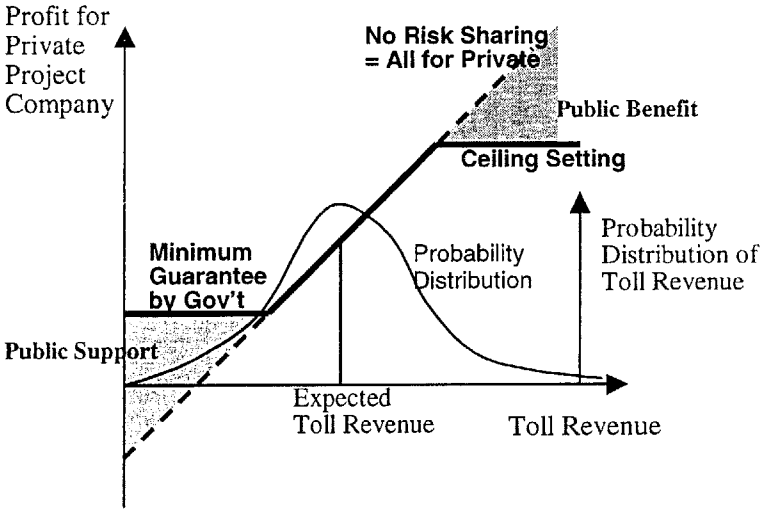

Figure 5-9 Toll Revenue Risk Allocation Example

There are many other forms of governments' financial supports. For instance, the Confederation Bridge and the California's projects had provisions of exclusivity agreement to protect the project company from competitions for a considerable duration. In the Sydney Harbour case, as well as British Dartford Bridge case, although not studied in Chapter 4, the project company was allowed to raise construction costs by the revenues

from the existing tunnels. In Japan, redemption period extensions, similar to the mechanism of the concession extension, are now popular among toll roads managed by the public sector agencies, although they are public in nature.

Government financial supports used in the cases studied are summarized in **Table 5-5**, together with desirable instruments for the prospective PFI toll road projects, explained shortly.

Table 5-5 Government Financial Supports Used in the Cases Studied and Desirable Instruments for the Prospective PFI Toll Road Projects

	Cases/ Project Types	Equity	Guaran-tee	Subor-dinate Loans	Grants	Revenue Guaran-tee	Shadow tolls	Others
Cases	Kurushima*	○	○	○	○	–	–	Redemption Extension
	TB Aqua-Line*	○	○	○	○	–	–	
	Confederation Bridge	–	○	–	○ Ferry fare Equiv't.	○ Min. floor level	–	Non Competition Clause
	HW407*	○	○	○	○	–	–	–
	SR91, SR57	–	–	○ (Local)	–	–	–	Exclusivity No Right-of-way
	Sydney Harbour Bridge	–	–	–	○ See 'Others'	○ Min. traffic	–	Revenue from Bridge fair
	DBFO roads in UK	–	–	–	–	–	○	–
	Kanamachi & KPC, PFI in Japan	–	–	–	–	–	–	Service Sold to the Public Type
Proposals	Bridge /Tunnel	–	–	○	(○)	(○)	(△)	Tax credit Other crossings
	Bypass roads	–	–	○	(○)	○	(△)	Tax credit
	Network	–	–	○	○	–	△	Tax credit, Concession

* ○: Used for cases, Effective or recommended for proposals, (○): Sometimes effective or recommended, △: Somewhat effective, (△): Sometimes somewhat effective
Kurushima, TTB, and HW407 are non-private projects.

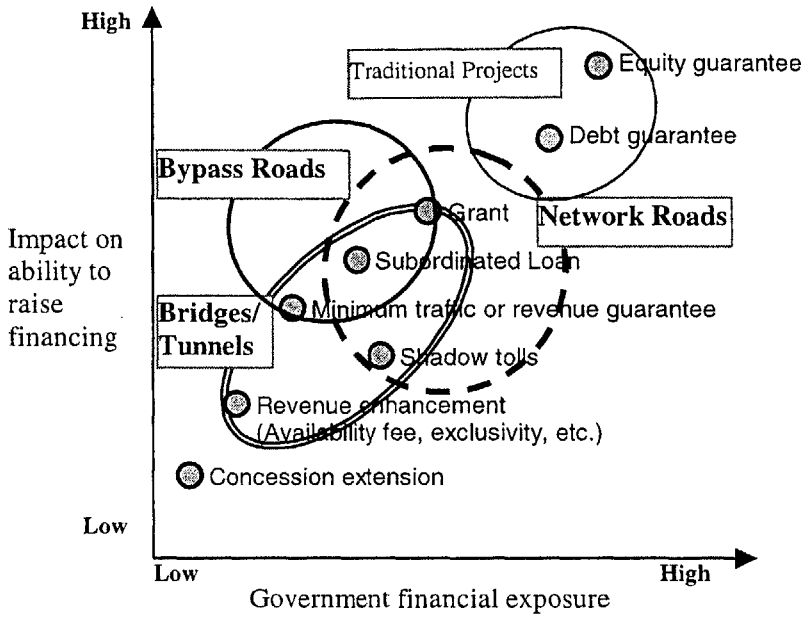

Figure 5-10 Types of Government Supports and Application for PFI Toll Road Projects (Source: Fisher and Babbar, 1996, Added)

Figure 5-10 illustrates the types of government supports and desirable applications for potential Japanese PFI toll road/bridge/tunnel projects. In the traditional toll road projects, including Kurushima and Tokyo Bay Aqua-Line projects, since the government raises all necessary finance with national expenditure and guarantees, financial exposure of the government to project risks is very high (See the rightmost circle). By utilizing the PFI scheme and project financing for a toll road/bridge/tunnel project as a private project, the government literally supports the project by means of less risky financing tools or by just giving the project company some accounting benefits, such as tax exemptions.

Desirable combinations of the types of government supports should be chosen according to the feasibility and the risk profile of the project. For instance, minimum revenue guarantees would be effective and desirable for bypass roads that have sufficient traffic volume with high probability, but not effective for network roads because the guarantees might reduce private sector's incentive. Subordinated loans would always be effective for the private sector project company and might benefit the citizens if the project turns out to be successful. Grants, on the other hand, may not be effective from the perspective of the taxpayers for the projects with enough profitability. Bridges and

tunnels may need other revenue enhancements, such as concession rights of operating the existing crossing and an exclusivity clause in the agreement.

(5) Tolling System

Toll Collection System

Japan's expressway system has in earnest started adopting the ETC system since April 2001, and the ETC is expected to gain popularity in a few years. The widespread availability of the ETC system involves tremendous potentials in the operation of the toll road project.

HW407 project, for example, utilizes most advanced measures for the toll collection with the contemplated AVI/ETC system (See Section 4.2.5). Amazingly, the system does not require any tollbooth, any speed reduction, or even transponders, although cars with a transponder are charged discounted tolls. In addition, the toll collection system is capable of accurately detecting and identifying vehicles under all operating conditions with an accuracy of 99.995% according to the Request for Proposals. The system is adopting congestion pricing and various pricing dependent on the payment method, by which users with a transponder can enjoy the cheapest rates.

Potentials of the ETC include various promotion programs coupled with ancillary facilities such as restaurants and accommodations in the service areas or community businesses such as leisure parks, golf courses, conference complexes, and so on. Japan's ETC system has adopted double equipped system, which requires both a personal electronic card to charge the tolls and on-board transponder to detect the car, so that not only the user may drive more than one car, including a rental car, but also go shopping to the allied stores, for example, with the card.

A well-known episode about early operation of HW407 may suggest something to Japan's projects that cannot attract road users as expected, such as Tokyo Bay Aqua-Line and Honshu-Shikoku Bridges. When the scheduled commencement day came, the ETC system was still subject to verification. Hence, the expressway opened for free for a while. The users who had already used to enjoying a non-congested "free" route, even with enough information of the breakthrough toll collection technology, could not return

to the real free route from the congestion-free toll route even after they began to be tolled, in part because nothing had changed thanks to the non-tollbooth, freeway-like system.

Combination pricing

Combination pricing of real tolls, shadow tolls, and availability fees should be considered for bridge/tunnel projects, which may need governments' financial supports to cover the expensive construction cost, being consistent with the public policy. Combination pricing, rather than higher rates of real toll only, must attract drivers to use the bridge/tunnel, and as a result, the economy of the both sides of the bridge/tunnel would be boosted as the policy expected. Although the combination pricing has not been experienced in any of the cases, since the government furnishes both equity and debt guarantees for current toll road projects (See **Figure 5-10**), providing shadow tolls and availability fees of proper levels, instead of equity and guarantees, entails reducing government exposure to the project risk.

(6) Another Financing Scheme – Utilization of the Capital Market

Financing Arrangement. An elaborate financing arrangement can be a means of the financial risk mitigation. The PFI also induces the developer or financial institutions to create innovative financial instruments as an example of new business creation, which is one of the objectives of the Japanese PFI. For instance, in the Sydney Harbour Tunnel project, a CPI indexed bond was developed and issued as a crucial financing instrument.

Among the cases studied in Chapter 4, the Confederation Bridge, Sydney Harbour Bridge, and some of the DBFO roads in the U.K. projects issued different types of bonds to attract third party investors, while none of Japan's primary PFI projects did. The revenue bond, often utilized in the U.S., such as in the plan of the SR57 project, is another alternative to stimulate investment.[27] Given that bond issuance can be an effective financing tool, it is important to consider the utilization of the capital market to finance toll road/bridge/tunnel projects with the Japanese PFI scheme as an enhancement of financial resources, although financing by loans from financial institutions would remain the most important position.

[27]If a revenue bond is issued to build a bridge, the tolls collected from motorists using the bridge are committed for paying off the bond. Unless otherwise specified in the indenture, holders of these bonds have no claims on the issuer's other resources. (Dictionary of Finance and Investment Terms, 1998)

The political movement is currently favorable in this regard. The ruling parties have established a tax reformation plan that exempts individuals from taxation on certain income by the sales of stock, for example. It should be noted, however, that the goal of investment stimulation can be best achieved through actions that will reduce market uncertainty (i.e., indemnification) and future risks, rather than through more commonly used measures like tax incentives. (Liddle, 1993)

Significance of the Utilization of the Capital Market. If the capital market is utilized for the project finance of PFI projects, the capital structure of the project company would become as the right-hand side of **Figure 5-11**.

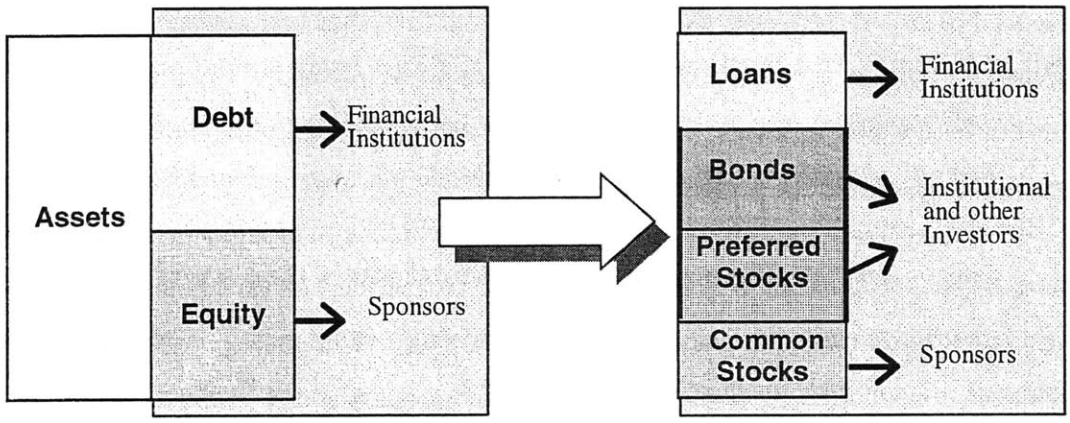

Figure 5-11 Significance of the Utilization of the Capital Market for PFI Project Finance (Source: JAPIC, "Report for the PFI Projects")

The main significances of the utilization of the capital market are the following three. First, if the project can attract third party investors, the financing costs of the project company may be reduced. Institutional and other investors have a variety of investment needs that are different from those of the financial institutions (lenders such as banks), depending on their portfolio structure. Some investors such as life insurance companies are likely to be interested in the long-term feature of the project finance of PFI projects. Secondly, if the equity portion is attractive as an investment and the project company can issue the preferred stocks to investors, then the project company could draw loans with more favorable terms because financial institutions would be delightful with more equity as risk buffer. Third, revenue bonds may be sold to individuals, especially in the neighboring communities because not only the project would contribute to the community development, but also the investment would get return if the project is

successful. There are ¥1,400 trillion individual financial savings in Japan; these should be utilized for something like the PFI projects as investment,[28] as well as for helping to boost overall Japanese economy.

5.4.3. Issues Surrounding PFI Toll roads/Bridges/Tunnels Projects

A desirable framework has been developed in this chapter for the specific types of toll road/bridge/tunnel projects that have a potential to be feasible as a Japanese PFI project. Subsequently, more concrete examples and the application of the framework are tested in the next chapter. Nevertheless, it is imperative that some obstacles surrounding prospective PFI toll road/bridge/tunnel projects, in addition to more general issues raised in Section 3.5, be overcome.

Considering the circumstance of the implementation of the Japanese PFI, on one hand, that of potential PFI toll road/bridge/tunnel project has many favorable trends. Privatization trends, the structural reformation of financial and administrative systems, ITS systems developments, the capital market innovation, growing experiences of other types of the Japanese PFI, public involvement trends, little public resistance towards toll roads thanks to past experiences and little low-income citizens, and changes in business culture are among those, as discussed in this chapter.

On the other hand, the financial strength of both major banks and MCFs is currently under rehabilitation. Even though the both players may have the willingness to invest in a PFI toll road/bridge/tunnel, since such a project require the heavy initial investment, it would be difficult under the current economic situation in Japan. Moreover, the secure development of a network that smoothly connects the target project to another complete network is crucial for a toll road/bridge/tunnel project; however, the private sector cannot control the network issue in principle. Other inhibiting factors include the complexity of the scheme, policy and politic issues, arguably failure experiences, e.g., Tokyo Bay Aqua-Line and Honshu-Shikoku Bridges, limited probabilities for profitable projects, bureaucrats' hesitation to changes, the absolute power of the public sector, and Japanese MCFs' few experiences in BOT projects for infrastructures.

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[28] Japan Project-Industry Council (1999): Jisedai Minkatsu Jigyo (PFI) ni kansuru Hokokusho (Report on the PFI Projects –For the Realization of Project Finance–)

Joint efforts and initiatives of the public and private sectors with eagerness to implement the Japanese PFI, is essential to the development of projects such as the toll road/bridge/tunnel project. The framework developed in this chapter, which contains viable project types, organizational structures, project selections, scope establishments, governments' financial supports, tolling systems, and the utilization of the capital market, should help the development.

Chapter 6. Generic Strategies for the Japanese Major Construction Firm

Chapter 6 proposes strategies for the Japanese MCF in the PFI context. Chapter 4 demonstrates that MCFs need to play a central role within the projects and to contribute significantly to technical problem solving, financing, and risk assumption; hence, MCFs should get returns for those contributions. From the perspective of the traditional business style of Japanese MCFs, it seems likely that the MCF tries to be involved in PFI projects just as a contractor, which obtains a construction contract and get profits from the construction work. However, with the PFI scheme, the MCF must contribute to preliminary works, such as planning and design, must prepare complicated, detailed documents for the PFI procedure, and must make the project profitable as the project company, while making the project company profitable conflicts with the MCF's interest, which is to earn more from the consortium. These additional burdens and strains, compared to the traditional contracts, must substantially lower the profit margin of the MCF in the PFI scheme despite foregoing contributions found in the cases. In order for the MCF to get returns equivalent to the contributions, the MCF should establish the strategies, which contain differentiation and equity contribution as demonstrated in this chapter.

In addition to the MCF's strategies in the Japanese PFI scheme, this thesis previously proposes a framework for prospective PFI toll road/bridge/tunnel projects in Chapter 5. In the latter half of this chapter, simulations for prospective Japanese PFI projects are presented to demonstrate the viabilities of the framework and strategies developed in Chapter 5 and proposed in the first half of this chapter, respectively.

6.1. Generic Strategies for the Japanese MCF

In order for the MCF to get returns with its strong potential for gaining better efficiency in a PFI project, this section addresses four strategies for the MCF: differentiation, equity contribution, both of which contain several elements to achieve.

6.1.1. Differentiation

Differentiation is one of three generic strategies to survive in the competitive marketplace, which Porter maintained in his "Competitive Advantage" in 1985.[1] Introduction of the PFI scheme has enabled the Japanese MCF to get equitable valuation for its capabilities, such as proper technologies and equipment, for the public sector projects in Japan cannot currently utilize those company-specific capabilities. For instance, the public sector cannot design any public facility that only single construction firm may have the designed construction means or have the specific equipment to complete the structure under the traditional Design-Bid-Build system. Although the MLIT (Ministry of Land, Infrastructure and Transport) has been developing improved delivery systems, the PFI would play a more aggressive role in changing the industry.

Some questions then follow the change: How can the MCF differentiate itself in the initial stage in a project? In other words, what kind of projects should the MCF initiate or aim for? When can the MCF strategically and effectively negotiate for the superior position in the consortium? How can the MCF attract potential partners like joint venture construction companies, top operation companies, and financial institutions? Key factors for the differentiation are differentiated resources, such as robust financial status, specialized talent and experiences, differentiated technologies and patent, and proper equipment. Nonetheless, it should be noted that the differentiation does not always allow the construction company to raise its price in bidding in this industry. Namely, the MCFs usually need both differentiation and cost advantage by the differentiation.

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[1] Porter, Michael E. (1985). Competitive Advantage – Creating and Sustaining Superior Performance
The other two are cost leadership and focus ("focus," or narrow scope, can be divided into cost focus and differentiation focus).

(1) Robust Financial Status

Robustness of sponsor companies' financial status is often put importance in evaluating and selecting the undertaker of a PFI or similar privatized project. As in the cases of California's AB680 projects, the Confederation Bridge, the Kanagawa Prefectural College (KPC) project, and also in the Guideline of the Japanese PFI, for example, the government agencies include the financial robustness of the member companies of the potential consortium as an important factor in the evaluation criteria. In particular, in the KPC project, the financial robustness of the winning company (Obayashi Corporation, an MCF) was significantly stressed in the final evaluation.[2]

Not only because financial robustness may be an important criterion in selecting a PFI undertaker, but financial robustness can be a great factor of differentiation of a MCF because it must be attractive to the investors or the lenders and the attractiveness entails lower financial costs, such as interest rates on the loans. For example, AAA-rated corporate bonds may be issued at lower yields by some 100-150 basis points, depending on the economic circumstance, than BBB-rated corporate bonds.[3] Even if the government furnishes low or non-interest loans to the prospective project company, the project company is always exposed to more or less default risk that all of the government, financing companies, and consortium partners would like to minimize. Therefore, MCFs, such as Kajima, Obayashi, and Shimizu, should consider financial robustness as a differentiation factor.[4]

(2) Special Experiences and Talent

In the Sydney Harbour Tunnel project, ample experiences of Kumagai Gumi in immersed tube tunnels were the crucial factor for the selection of the consortium. Not only did the experiences help them propose the complicated tunnel structure and the construction means but also the government could appreciate their overall proposal, which offered surprisingly low cost, with credit because of the experiences. Those who experienced the previous BOT project in Australia also greatly influenced both the

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[2] Although no relative weights of the factors of the criteria existed, the final announcement of the evaluation committee clearly stated that the creditability of the company was one of three crucial factors by which the company differentiated itself from the other consortia.
[3] Grinblatt and Titman (1998). Financial Markets and Corporate Strategy
[4] See Section 2.2.1 for Japanese MCFs' financial data.

selection and the subsequent negotiation with the public client. Kumagai's project manager and some others had a previous experience in another BOT project with Transfield, the partner in the Sydney Harbour Tunnel Company. This experience, together with other experiences in Hong Kong, let the talent work with prospective partners and led to the successful proposal.

The consortium for the Confederation Bridge contained four international MCFs, all of which had useful experiences in different areas of expertise for the construction of the bridge. *Northern Construction Co. Ltd.* is the Canadian subsidiary of Morison Knudsen Corporation, which built the Sunshine Skyway Bridge, the world's longest cable-stayed concrete bridge completed in 1987 spanning the Tampa Bay. The Sunshine Skyway Bridge is 29,040 feet (8.85 km) in total length with longest single span of 1,200 feet (366 meter), and more than 300 precast concrete segments are linked together. Experiences in this previous project, which had similar features, such as super-long structure and numerous precast concrete segments, helped the consortium in developing the Confederation Bridge project. *Ballast Nedam Canada Inc.* is the Canadian subsidiary of a Holland based MCF, Ballast Nedam International B.V., which took part in the Great Belt West Bridge project. In the West Bridge project, the company utilized its heavy lift vessel "Svanen" to install heavy precast concrete segments as done in the Confederation Bridge project. The experience as well as the proper equipment was one of the crucial factors in the project. *GTMI (Canada)* is the Canadian subsidiary of France-based GTM International. GTM participated in the concessionaire of the Second Severn Crossing project, one of the first privately financed projects in the U.K. There it gained experience in private packaging, including design, construction, financing, and operation and maintenance, which was similar contract structure to the Confederation Bridge project. *Strait Crossing Inc.* is only construction company with the 100% Canadian capital and had a reputation in Canada.

MCFs with special experiences or a combination of experienced firms and staffs therefore have a tremendous potential to create an exceptionally efficient project. MCFs should tap into their own experiences and talent.

(3) Differentiated Technologies and Patent

A differentiated, innovative technology can be the sole determinant of being rewarded. In the Highway 407 case, two consortia submitted a proposal, responding to the Request for Proposals, in which the government stipulated that the project be delivered by DBFO scheme by the selected consortium. After evaluating the two proposals, however, the government surprisingly dismantled the two consortia and decided to change the procurement rules so that the government would take the responsibility for the financing and the two consortia would "design and build" and "operate and maintenance" separately. The state-of-the-art toll collection system, proposed by the losing consortium as a design-builder, was such a valuable function that the government could not help select the technology, which would have been abandoned unless the government had made this abnormal decision.

JR East, a privatized railway company in Japan, took advantage of a differentiated technology of a MCF in the Numakunai Bridge project, as briefly described in Chapter 4. Kajima, a Japanese MCF, contributed to the 10% overall cost reduction of the project with its differentiated technologies, such as high-performance light-weight concrete and the external cable system. While Japan's traditional delivery system, Design-Bid-Build method, cannot allow the public agencies to adopt a differentiated technology that only single company owns, the public agencies may aggressively seek effective advanced technologies in future PFI projects. Consequently, developing and protecting original technologies as patents have become more and more important than ever in the Japanese construction industry.

(4) Equipment Proper to the MCF

Equipment proper to a consortium or an MCF can be the best differentiation in the competition. The heavy lift vessel, "Svanen," with the world's largest lifting capacity, was the solution of the construction of the Confederation Bridge under the extremely severe site conditions and environmental and time constraints. As introduced in Chapter 4, components of the bridge structure needed to be segmented in large pieces and precast in land to avoid operating in the difficult conditions of the strait as much as possible. To that end, utilizing the world's hugest vessel was the only possible alternative for the

project. (See Figure 4-10 for a picture.) In fact, every other competitor failed in complying with the government's requirement regarding the amount of the government subsidy.

Although not mentioned in the case description in Chapter 4, Kajima's unique self-elevating platform (SEP), "KAJIMA" (**Figure 6-1**), was also used for differentiation to bid the Kurushima Kaikyo Bridge project. Without this "vessel," it would have been virtually impossible, at the point in the middle of the strait where the current was very strong, to build a 44m-long, 2.0m-diameter pile, which the specification required the contractor to set as a guide for the quick, accurate installation of the prefabricated caisson during a short lull period of the current. SEP "KAJIMA" has the competent capacity for standing-alone in the middle of some 30m-deep strait, which flows at maximum velocity of 10-knot current, with a 100-ton crane on the deck. The Π-shape deck was also an important factor for "KAJIMA" because, on completion, the guide pile could be left behind the "vessel" through the open edge of the deck.

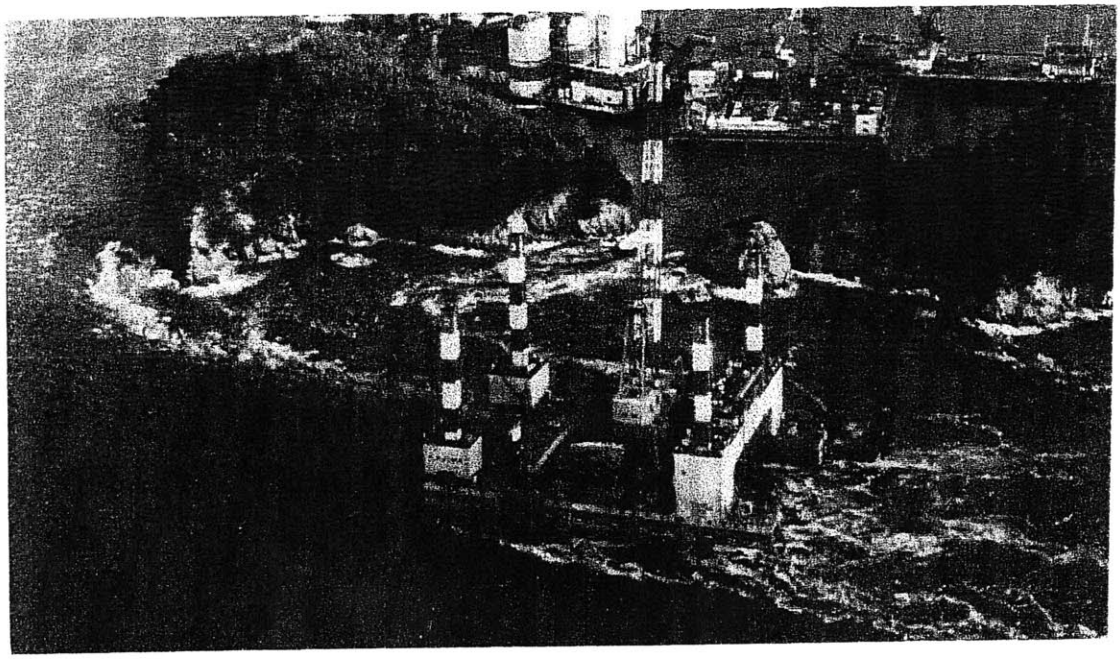

Figure 6-1 SEP "KAJIMA"

6.1.2. MCF's Equity Contribution

How can the MCF's differentiations be favorably priced in the competitive PFI market? It seems to be almost impossible that the MCF could obtain favorably priced construction contracts as a contractor in the PFI market because the private client is likely to require the contractors to bid more competitive price than the public agency would, even though additional costs, such as for preliminary planning, may grow significantly with the PFI scheme. However, the competitive advantage of the MCF with the differentiations, compared to other participants of the project, such as the financial institutions, should be rewarded by some means. One of the strategies for the MCF to achieve the goal may be the equity contribution, hopefully with some device to get early returns.

(1) Debt to Equity Ratio and Project Profitability

In implementing a PFI project, participating private companies need to establish an SPC. The SPC should be funded by both equity and debt, which would be used for the preliminary studies, conceptual and detailed designs, construction, and usually operation, and repaid from either the government or the users of the PFI public facility, for example, from tolls in the case of toll road project. Debt is sometimes repaid in full at the beginning of the operation stage, and the SPC, or the project company, must borrow the money for the repayment from any other investors, but usually, one supposes that debt is long-term financing and equity from the sponsors is retained for the lifetime of the project. In this thesis, "sponsors" are assumed to include MCFs.

Equity contribution ratio, or equity to asset ratio (E/A), signifies the sponsors' willingness and responsibility to take risks. Sponsors usually try to maximize the ***return on equity (ROE)***. As the less the equity, the better the ROE in general, sponsors are likely to try to reduce the investment amount and raise loans with better terms from the financial institutions. On the other hand, lenders (financial institutions) want to maximize the ***Debt-Service Coverage Ratio (DSCR)***, which is the ratio between the accumulated present value of annual cash flows before debt service and the total amount of the loan principal of the project. The more the DSCR is, the more profitable revenue stream the project will have during its lifetime, although the stableness of the revenue

stream depends on the risk profile of the project. Hence, other things being equal, the lenders usually seek as small a loan provision as possible, so that the lenders can secure the DSCR of 1.4 to 2.0.[5]

With regard to project profitability indexes, such as ***Net Present Value (NPV)*** and ***Internal Rate of Return (IRR)***, since debt bears interest while equity does not, higher equity ratio indicates better profitability of the project. In other words, financing with debt costs more than financing with equity. Therefore, larger equity portion is more desirable from the perspective of the project or the project company, although the sponsors must have a different perspective.[6]

Also important to consider is the structure of project revenue distribution in the PFI scheme, so-called "cash waterfalls" as illustrated in **Figure 6-2**.[7] If a PFI project, financed by "project finance," generates a revenue stream, such as tolls from a toll road, the revenue must be first spent for operating costs, including maintenance of the facility, general, administrative expenses, and tax payments. Next, the net income from operation must be spent for the debt service according to the priority of each debt, that is, from interest and amortization of senior loans, then debt service reserve accounts and general reserve accounts, to interest and amortization of subordinated loans. And finally, if the project is profitable enough, the remaining profits can be distributed to the investors and sponsors as dividends and retained for future investments to run the project.

As one can understand from the figure, the smaller each basin of a waterfall is (i.e., the smaller the debt burden is), the earlier and the more the profit flow would fall into the final basin, or into sponsors' pocket, other things (volume and speed of the water flow, or revenue stream) being equal.

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[5] Ohara, Katsuma (1997). Project Finance

[6] In actuality, debt financing has advantageous features, such as tax deduction benefits, over equity financing.

[7] Buljevich and Park (1999). Project Financing and the International Financial Markets

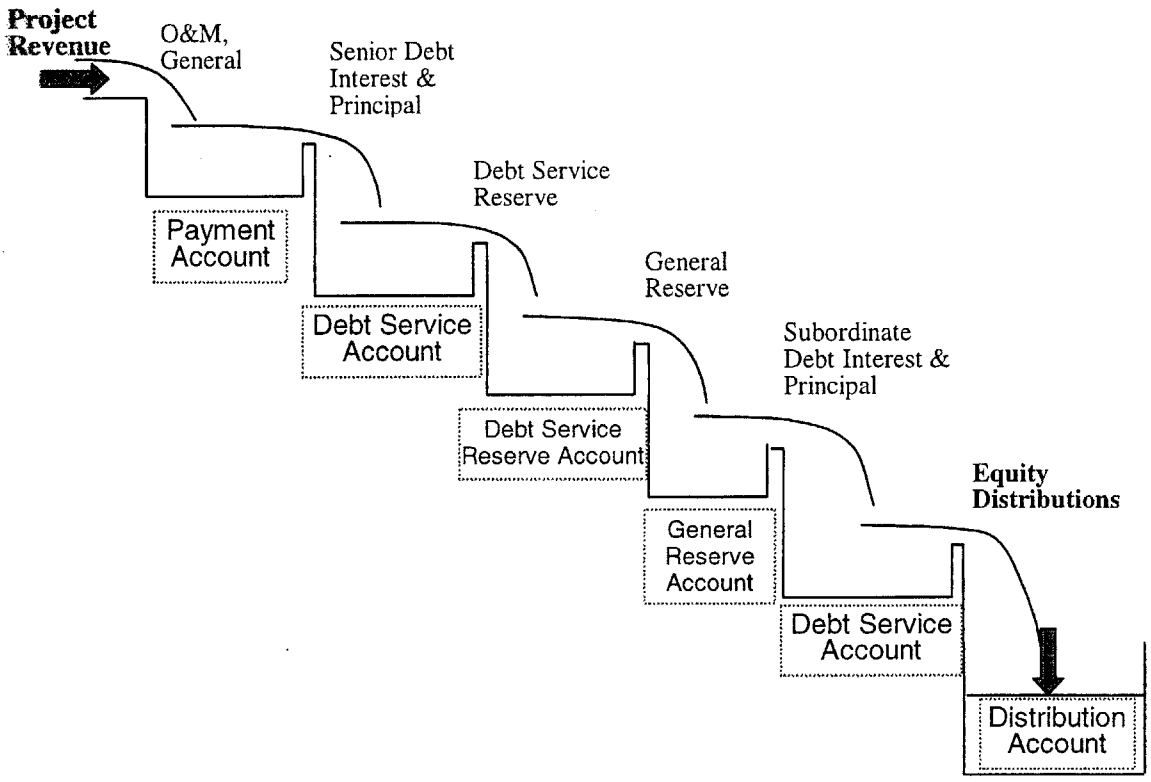

Figure 6-2 Cash Waterfalls of Revenue Distribution of a Project

(2) Equity Position for MCFs

As seen in Chapter 4, MCFs in the world have played important roles in privatized toll road projects and in other types of projects in Japan. Nevertheless, it may not always be the case that the MCF has received sufficient return, which is equitable to the contribution it made in the preliminary and construction stages, from the privatized project in foreign cases. On the contrary, the MCFs and GCs that participated in the Kurushima Kaikyo Bridge and Tokyo Bay Aqua-Line projects had considerably profitable contracts in the traditional public-finance system even though the projects themselves have been as yet far from profitable. When the MCF takes the PFI scheme into consideration, some strategies to retain sufficient profits would be needed.

The competitive advantage of the MCF with the differentiations, compared to other participants of the project, such as the financial institutions and operation companies as well as competitors in construction, should be rewarded by some means in the Japanese PFI scheme. This can be achieved only by taking calculated risks, that is, by seeking opportunities to get more return on investment with deliberate strategies.

From the standpoint of the consortium and the investors of the project, if the bid price is critical to the MCF for being awarded the project, the lower the price, the more profitable the project should be. But this is not true from the standpoint of the MCF. The increased profit from lowering the price goes to those who take risks by contributing equity for the project and to the financial institutions that take smaller risks by lending money for the project, as well as to the citizens, or the taxpayers, without any compensation to the contractor that offered the lower bid price but not contributed equity.

In addition to the MCF's incentives for being involved in the equity position for profits, the necessity of the MCF's involvement exists. In the competitive market as in the PFI, an owner or the project company tries to squeeze the construction cost. Therefore, the MCF is unlikely to get a profitable contract on a traditional lump sum plus contingency basis; rather, the project company would require the MCF to accept a more severe GMP-base contract.[8] The PFI thus cannot benefit the MCF without MCF's equity contribution. MCF's equity contribution is also attractive to the project company because additional equity position of the MCF would replace the money borrowed from banks with expensive interest.

Equity contribution, however, exposes the MCF to the overall project risk to a substantial extent. If the project fails for any reason, the MCF contributing equity to the project company would lose the source to repay the investment and might face a financial problem as a sponsor company or at least reduce the net worth of the company. Hence, it is essential to be careful about to which projects and under which conditions the strategy shall be applied. The following deals with this issue.

(3) When to Apply the Equity Contribution Strategy

Under the Japanese PFI scheme, where private investment is strongly encouraged like other areas of business, the most valuable opportunities may come with a great deal of uncertainty, which entails substantial risk. The MCF should take the risk to cultivate the opportunity under certain conditions. **Figure 6-3** and **Figure 6-4**, as well as the discussion in Chapter 4, may help understand the risk profile of a toll road project and the relation between a specific risk and its influences on return.

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[8] "GMP" stands for the Guaranteed Maximum Price contract, under which the construction cost will not exceed the set maximum price in any circumstance except truly extreme occasions.

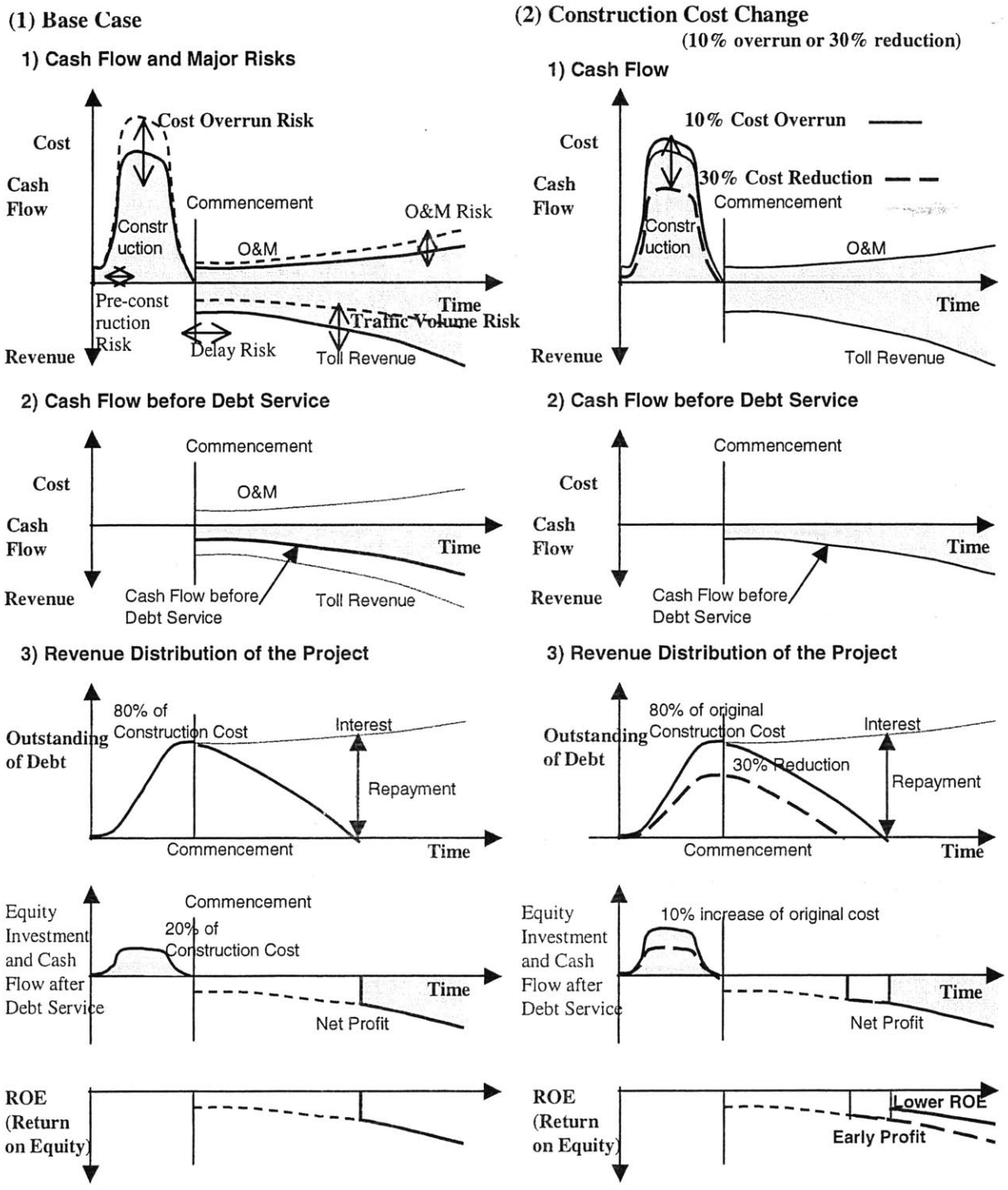


Figure 6-3 Risk-Return Profile in a Toll Road Project (1/2)

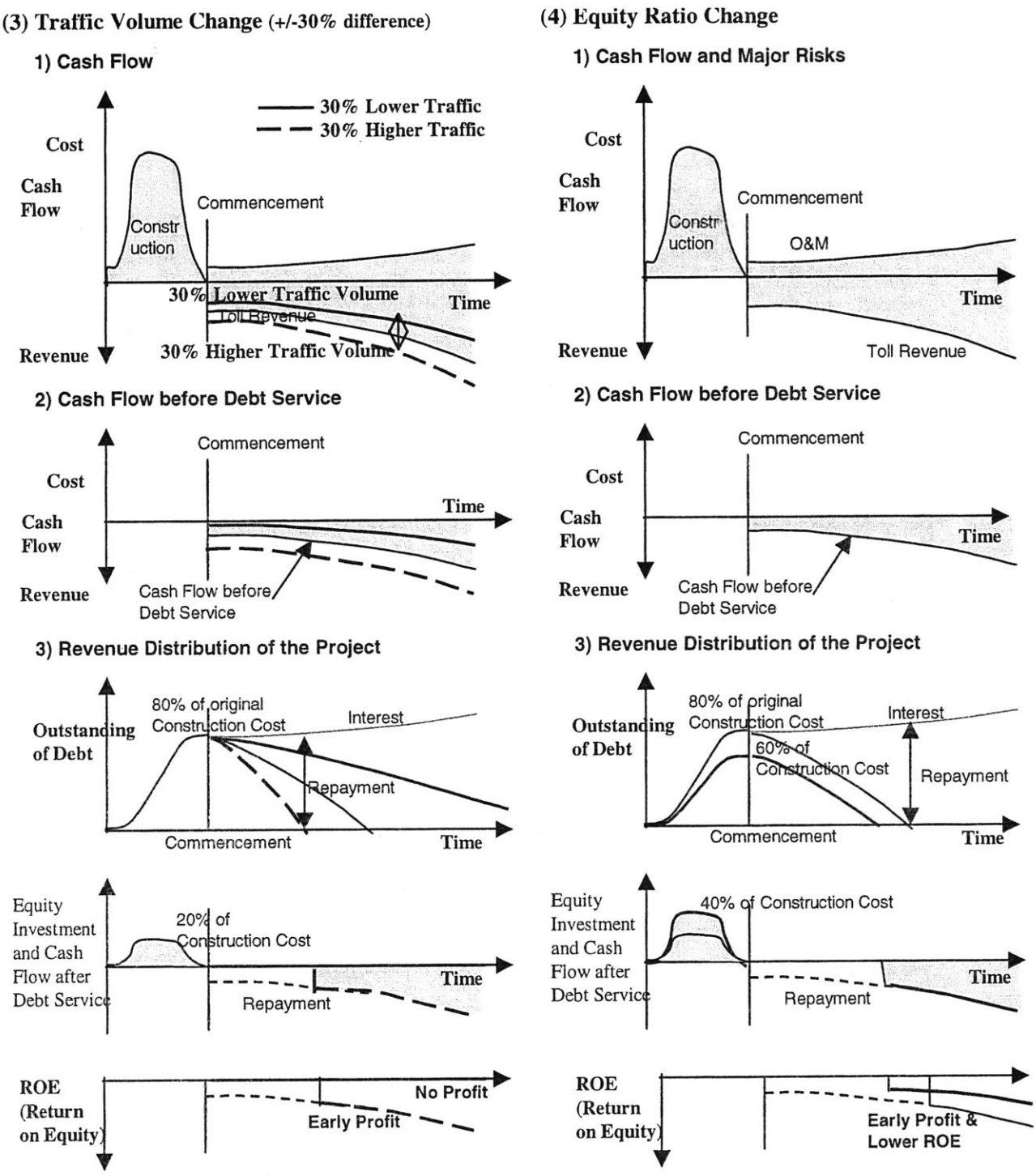


Figure 6-4 Risk-Return Profile in a Toll Road Project (2/2)

Although this figure demonstrates the conceptual relation between risks and returns, the quantitative level is intended to be meaningful (Actual simulations are presented later in this chapter. See Section 6.2). As the figure shows, construction cost

difference, if some 10% variance is assumed, would moderately deteriorate the profits of equity holders (Lower ROE), while lower traffic volume than expected would never give return if 30% variance is assumed (zero ROE). If the construction cost is reduced by 30%, for example, as may be expected in a bridge/tunnel project, earlier and more return to the sponsors would achievable, while the 30% traffic volume increase case would produce further more profits to the sponsors in this model. Changes in equity contribution ratio (from 20% to 40% in equity) may have significant effects on when the sponsors get returned, and the possible loss would double if the project fails, whereas the original case (20% equity) would limit the maximum loss of the sponsors up to at the less equity level.

Having estimated the relation between risk and return of a toll road project and the potential of an MCF to improve the project risk profile, as studied in Chapter 4, especially in the design and construction stages, the MCF should take the risk to cultivate the most valuable opportunity when most of the following conditions are met. In other words, however, if none of the following conditions applies to the potential project, the MCF shall never take the risk by the equity contribution strategy.

a. All risks except the completion risk should be well mitigated or transferred. This is almost a mandatory condition. The MCF could mitigate the demand risk, the political risk, and the regulatory risk with the organizational framework, proposed in Chapter 5, which utilizes an existing public corporation in expressway development projects. The MCF could also transfer the financial risks to the financial institutions and the operational risks to the operating companies to a substantial extent. If, by this risk allocation, only the completion risk, or the construction risk, is the greatest concern to the MCF, it should assume the risk, seeking the most possible benefit. For example, in the Sydney Harbour Tunnel project, the project company comprised of two MCFs, Transfield and Kumagai (i.e., only the two MCFs raised equity), transferred the traffic volume risk to the government, economic risks to the users and financiers by means of CPI related tolls and bonds, and operational risks to the operation company. Although the equity-to-asset ratio (E/A) is minimal and the surplus from the excessive traffic volume has benefited the government, the MCFs have enjoyed high ROE from the successful project.

b. The project may include a large potential to develop innovative construction means. The project might become much more profitable than it originally seems to be if the construction cost can be reduced by efficiently designing and developing innovative construction means. The cost of risks, or risk premium, is inexpensive if the risks can be managed well, and accordingly, the MCF's risk premium against the risks of the project related to its construction must be the least expensive among the participants. Since the improved profitability is almost always attributed to the MCF, the MCF should be rewarded for this by being given the opportunity to assume inexpensive risks with expectation for larger return, rather than giving the opportunity to the financial institutions, which would assume the risks by requiring expensive compensation. For instance, if an MCF faces a technically complicated project that has a reasonable profitability and if the most influential risk is the completion risk in conjunction with the technological difficulties, which the MCF assumes resolvable with significant cost reduction by means of a new technology, as was the case in JR East's Numakunai Bridge project, the MCF should invest in the project even through waiving the profit margin earned by the cost reduction because the project must be worth investing, should it have little completion risk.

c. The MCF has the capability of Life-Cycle-Engineering that is essential to the project. The MCF would be expected to efficiently design and construct a public infrastructure facility so that the life cycle cost will be minimized. Maintenance costs of the existent facilities have rapidly grown in recent years, and thus major MCFs have set specific divisions for maintenance in Japan. They have improved and developed various durable repairing methods and materials, which can be adapted for new construction. Therefore, the MCF should bear, at least in part, the risks in the O&M stage. Some of the DBFO roads in the U.K. and the SR91 project required the project company to have the capability to manage the project especially in the operation stage. The Life-Cycle-Engineering function and the knowledge of the operation are indispensable for the MCF to invest in the project to a substantial extent.

d. The MCF has the know-how of the whole project development. If the MCF has divisions or subsidiaries that include developing or operating capacities for the project, as is the case in the Japanese construction industry, the MCF could control most of the risks

related to the project, i.e., almost all of its internal risks. Such a case places more emphasis on the importance of the involvement of the MCF in the equity position.

(4) Equity Contribution Example - "GMP and SO" Contract

By taking the superior position in equity, even though this means exposing itself to risks, the MCF could negotiate with partners within the consortium (the project company) for the advantageous risk sharing or financing position, such as options, preferred stocks, and other financial scheme exclusive to the MCF. A financing arrangement involving the MCF also can be a resource to reduce the cost of the project from the project company's standpoint. If, by some means, the MCF invests in the project more than a nominal portion as a sponsor and, at the same time, if the MCF has incentives to lower the construction cost more than usual as a contractor, the project could be more efficient. The following, "***GMP and SO (guaranteed maximum price and stock option)***" contract with the consortium, is one proposal of such means to be considered.

With the "GMP only" contract, a GC (General Contractor, not necessarily MCF) guarantees the maximum price it will require the owner (the project company) to pay for the construction under a certain condition even if the actual construction cost exceeds the guaranteed price. The GC usually has some incentive in this contract; if the actual construction cost is lower than the guaranteed price, half of the cost reduction, for example, is paid back to the GC.

On the basis of the "*GMP and SO*" contract, the MCF will obtain a stock option[9], whose amount equals to the cash amount, which would be reimbursed with the GMP (only) contract, as explained in **Figure 6-5**, if the cost reduction takes place. The stock option is the right, but not the obligation, to buy the project company's stock for the predetermined fixed price, which is likely to become below the market price when the construction is successfully done. With the "GMP and SO" contract, the MCF would have more incentive to work efficiently in order to reduce the construction cost because the more it reduce the cost, the more stock it could obtain; and the stock value would significantly increase because the completion risk, which is usually substantial among project risks, would turn out to have been avoided and because the surplus budget for the

[9] "Stock Option" used here is not necessarily same as that generally used in the current business practice.

construction would be used to repay the debt earlier than scheduled. **Figure 6-6** illustrates the process and effectiveness.

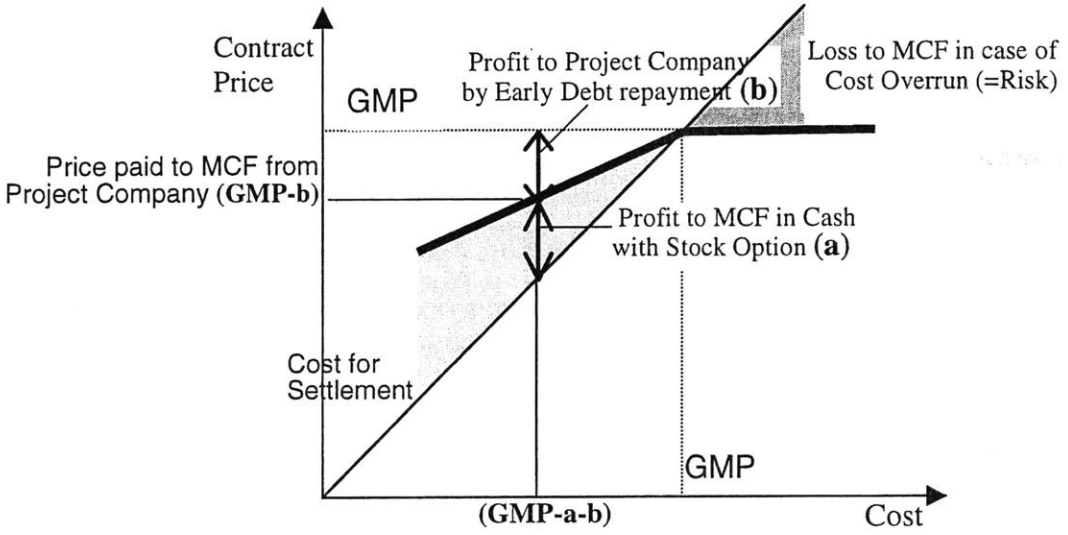


Figure 6-5 Proposed "GMP+SO" Contract System

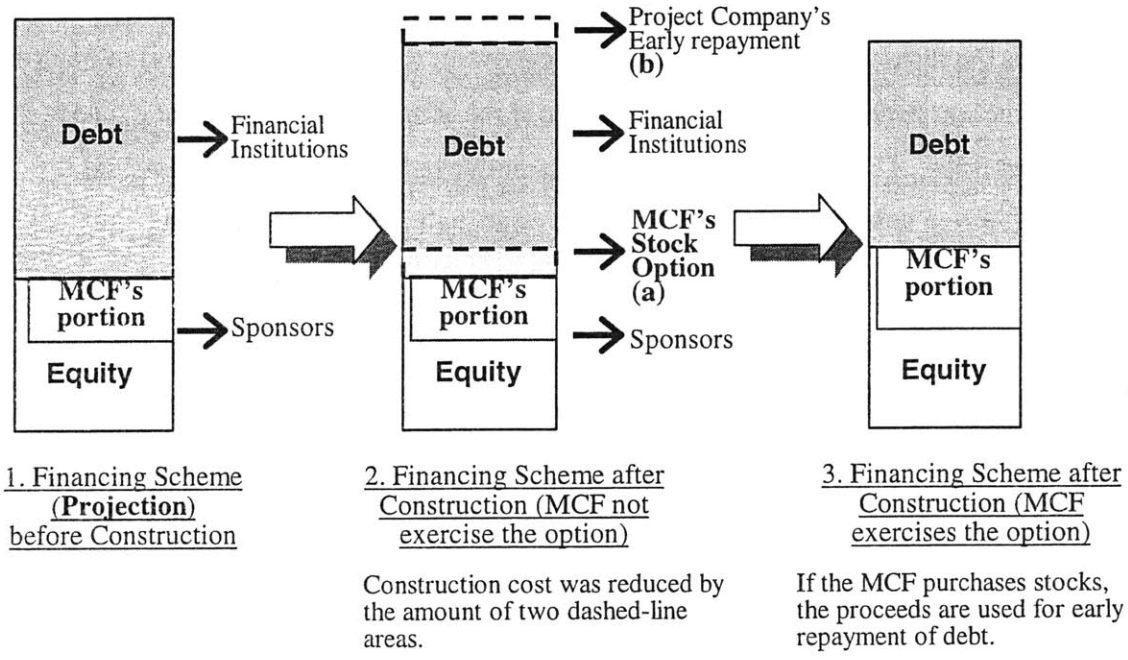


Figure 6-6 Financing Scheme Transition by "GMP and SO" Contract

The GMP contract with the stock option as an incentive for the MCF is good for the project company, too. If the construction cost becomes less than the GMP, as is likely the case, it would decrease the amount of the debt and improve the DSCR, or the debt

soundness, of the project on the early repayment of a portion of the debt. Accordingly, as this improvement attracts investors or other project sponsors, the value of the stock would increase. Moreover, if the MCF exercises the stock option and obtain additional stock, substituting the debt in most part (as right-most chart of **Figure 6-6**), the overall financing structure of the project would become still more favorable for the project company.

The MCF is encouraged to exercise the option and this is likely the case if the improvement of the project profitability becomes apparent when the project successfully completes with the MCF's tremendous contribution. The MCF, if it is not willing to bear the risks in the operation phase, could sell the obtained stock to the operation company or other investors at the market price (or discounted price, but higher than the purchased price).

This measure is reasonable because the MCF could earn the equitable benefit when it contributes to the project profitability improvement. A numerical example and the effect of the concept are demonstrated in Section 6.2. However, GMP itself needs to be competitive price to win the project, so the MCF needs either competitive differentiation advantage to involve a sufficient margin or extra efforts for extreme efficiency to reduce the cost from the competitive GMP price.

(5) Utility Function Concept

Utility function concept, as well as portfolio management described shortly, also should be considered for the MCF's financial management in adopting the equity contribution strategy.

What the Utility Function is

Every individual or entity has different preferences for taking risks, or gambling. For example, some are eager to gamble slot machines while others never. Even the same person, who used to gambling slot machine, may reject to gamble roulette even if the roulette has much better expected return. Assume that a person (M) is willing to pay up to $4 to get an opportunity to take a lottery (A) whose outcome is $10 with a probability of 50% or nothing with a probability of 50% (The expected outcome of the lottery (A) is $5), but that he (M) would pay up to only $10 for another lottery (B) that has 50% chance for obtaining $100 and 50% for nothing even though the expected mean value of the

lottery (B) is $50. Also assume that another person (W) is willing to pay up to $5 to get an opportunity to take the former lottery (A) in the previous assumed example, and that she (W) would pay up to $35 for the latter lottery (B). As we can see in these realistic cases, the more the deviation, the more risk-averse people would become (Both M and W pay less amount compared to the expected return for the lottery (B), which is more fluctuated), and the tendencies of these risk preferences are different from person to person, depending largely on their asset level (We can reasonably suppose that W has more assets than M, and thus she is less risk-averse).

Utility function expresses a person's relative preferences among a set of consequences (often defined over a continuous range). Utility function can be defined as U (C) as follows. For each Ci, a decision maker can specify a number U (Ci), with 0<=U (Ci)<=1, such that the decision maker is indifferent between "possessing Ci with certainty" and "the lottery L (Cmax, Cmin; U (Ci), 1-U (Ci))."

where, L is a lottery with two outcomes, Cmax, Cmin, which have the probability of U (Ci), 1-U (Ci), respectively.

In the assumed example, his (M's) *certainty equivalent (CE)*, Ci in the definition equation, for the lottery (A) is $4 and for the lottery (B) is $10, while her (W's) certainty equivalent for the lottery (A) is $5 and for the lottery (B) is $35.

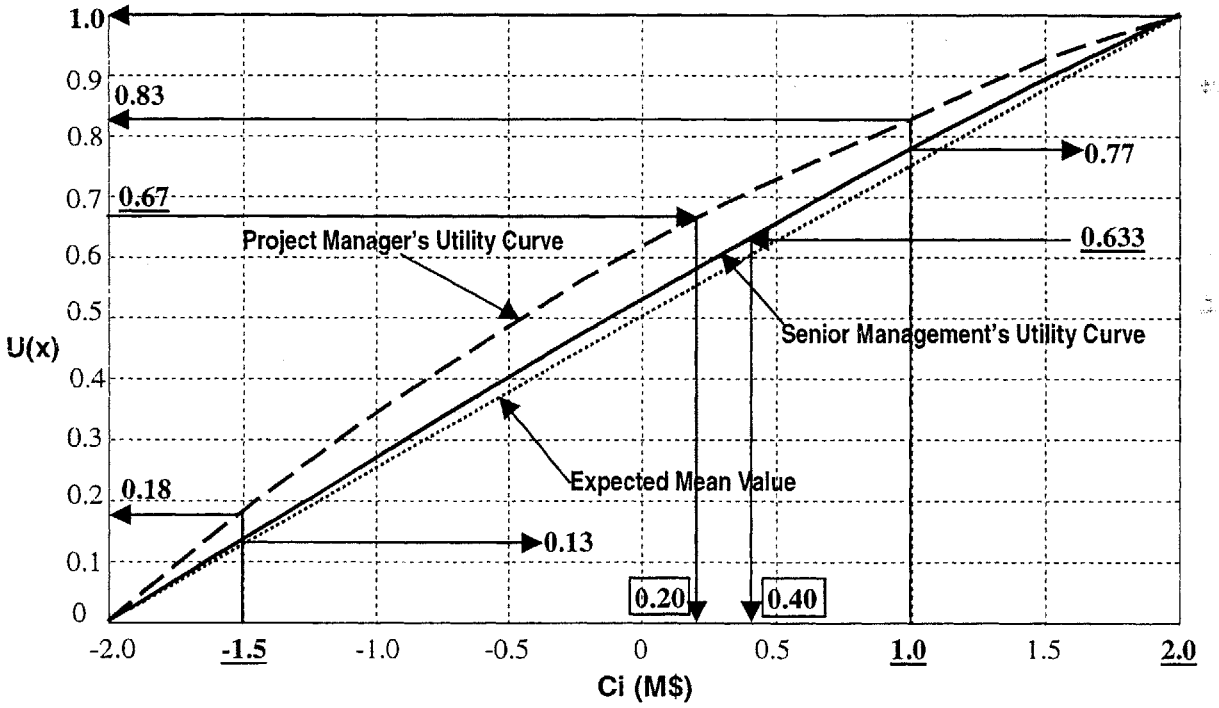
Risk premium (RP) is defined as the difference between a person's certainty equivalent for a lottery and its expected mean value (EMV). Therefore, since the EMV of the lottery (A) is $5 and the EMV of the lottery (B) is $50, M's RP on the lottery (A) is $1 and on the lottery (B) is $40, while W's RPs are $0 and $15 respectively. Obviously, W is more risk favorable than M. (The more risk premium, the more risk-averse.)

How to apply the Utility Function Concept

In making a decision on an investment in a project, the utility function of the project manager and that of the senior management may be very different. Because the senior management is responsible for the whole balance sheet of the company, while the project manager is responsible for that of only the project, the senior management can see the project as only a small part of his or her responsibility. This never means that the project is not important for the senior management, but that the utility function of the senior management must be more favorable for the project than that of the project

manager, who is generally risk-averse, just as Bill Gates would not care about gambling $1 million for even a little expected return, though the average person care and cannot gamble. The utility function concept is illustrated in **Figure 6-7**.

It is important for the project manager to know the difference and to dare to propose his or her established project scheme to the senior management as long as involved risks are thoroughly examined and properly mitigated and allocated. In competitive biddings in Japan, the larger a project, the more likely a major GC gets awarded, even though the project can be achievable for mid-size GCs and mid-size GCs have the advantage in terms of their less costly administrative and general costs. This fact may be the evidence that the larger firms have more advantageous utility function because of their larger total assets.



Provided that the utility curves are given as above and, to simplify the situation, that a project has the possible outcomes of $-1.5 million, $1.0 million, and $2.0 million, with 1/3 probability each, CEs of the project for the project manager and for the senior management are calculated as follows.
For the project manager, U(CE)= (0.18+0.83+1.0)/3= 0.67. Thus, CE(PM)= $0.20 million.
For the senior management, U(CE)= (0.13+0.77+1.0)/3= 0.633. Thus, CE(PM)= $0.40 million.
Therefore, the project is worth $0.20 million for the project manager, whereas it is worth $0.40 million for the senior management. (Note that the expected mean value of the project is $0.50 million.)

Figure 6-7 Utility Function Concept

Risks for MCFs and Probability Distribution

An MCF has numerous (thousands of) projects, with the largest one of 2-3% of its annual revenue, which takes several years. But, the profit margin is quite small, and operating income and net income are very small compared to the revenue or assets magnitude (for example, compared to its annual revenue of ¥1.1 trillion and the assets of ¥2.0 trillion, Kajima's operating income was ¥39 billion (4% of revenue) and net income was ¥7.6 billion (0.7% of revenue) in FY1999). Thus, huge loss in a single project could affect much on the company's total financial status. This feature should also be included in the utility function of both the project manager and the senior management. Nevertheless, this would not change the concept of the discussion above.

(6) Portfolio Management

A company must diversify its financial structure so as to best allocate financial risks and to achieve best returns. Diversifications are necessary in size of debt, durations, interest rates, types of risks, and investment types and products.

Portfolio management is a similar concept to utility function in considering the firm's total assets, but different in that portfolio management is more objective and it requires a definition of the statistical feature of the target project. As in the application of the utility function concept, the project manager needs to have a company-wide standpoint to finally evaluate the project. Portfolio management is important when management makes decision on whether to go for a project, regarding involved risks and returns of its all projects both on going and in the future. The best mix of the projects, or the risk allocation, is the way to generate profits most. Moreover, management could take the calculated risks by considering overall assets of the company, which makes its utility function stronger than when considering a single project.

If the expected return of the project and that of the company's portfolio have a negative or low enough positive correlation coefficient, the project would reduce the variance of the company's total portfolio, keeping its expected return at the same level or increasing it (**Figure 6-8** illustrates this concept). In the current industry situation in Japan, since the expected return of the portfolio is largely affected by the decreasing volume of the public works, while the expected return of a PFI project would be mostly

influenced by the financing structure itself, or the risk allocation only, the covariance of the two might be nearly zero. Thus, an addition of a PFI project generally has positive effects from the perspective of the portfolio management as long as the project has a substantial expected return.

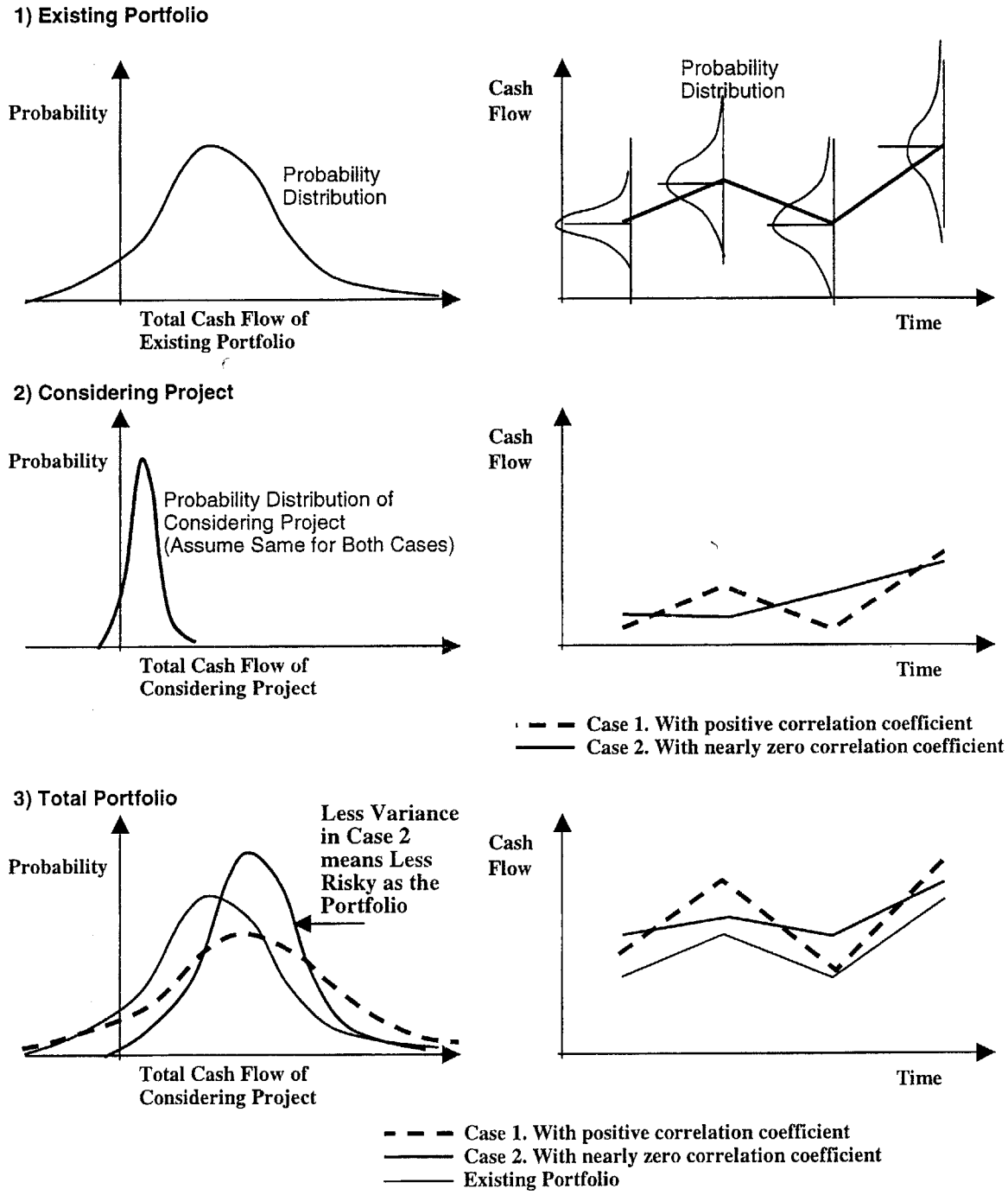


Figure 6-8 Portfolio Management Concept

6.2. Application of the Framework and Strategies

This thesis proposes a framework for prospective PFI toll road/bridge/tunnel projects in Chapter 5 and the MCF's strategies in the Japanese PFI scheme in Chapter 6 (the foregoing section). This section presents simulations for a prospective Japanese PFI project, based on the framework and strategies developed in Chapters 5 and 6 to demonstrate their viabilities.

Factors of the framework to test are: 1) the influence of the private sector's efficiency with construction cost reduction, 2) the advantage of utilizing the governmental bank (the Development Bank of Japan) to bring in a low rate of a subordinated loan, 3) the effectiveness of hedging the traffic volume risk by setting a minimum floor level or adopting a shadow toll system, and 4) the merit of introducing a public capital market to attract general investors. Overall financing scheme or the project structure may become favorable to the financial institution (the loan lender) and entail a lower interest rate of the loans and bonds issued. The effect of lowering the interest rate is also presented.

Factors of the MCF's strategies to test are: 1) the potential an MCF has in a PFI project implementation along with the MCF's competitive differentiation that brings about significant cost reduction in the construction stage, 2) the effectiveness of the equity contribution strategy and the potential of the "GMP and SO" contract.

6.2.1. A Bridge Project Simulation

(1) Outline of the Project

In Chapter 5, a bridge/tunnel project or a congestion reliever project with technical complicatedness and a sufficient traffic volume projection is suggested as the most prospective type of PFI toll road project in Japan. Among prospective bridge/tunnel projects in Japan, this section studies the ***SK Bridge project*** and tries to demonstrate the viability of the framework and the strategies developed earlier in this thesis.

The SK Bridge is an actual project currently in the planning stage, and the descriptions and the simulations in this section are based on a preliminary study report.

However, names of the location and figures of the original calculation are altered without sacrificing the reality of the project, to protect the confidentiality of the source or to simplify and focus on target issues.

The SK Bridge will be a portion of a toll road with four lanes and the speed limit of 80 km/h, and the length of the bridge is planned to be about 2.5 km. The project will connect two major metropolitan areas in the region in order to benefit the residential communities of the both sides, to relieve the congestion of the existing two other crossing roads, to develop the business of the both areas, and to provide a redundancy of the traffic networks. The project is expected to provide more than ¥200 billion economic effects and 17,000 job opportunities. Pertinent road networks and the location of the bridge are illustrated in **Figure 6-9**.

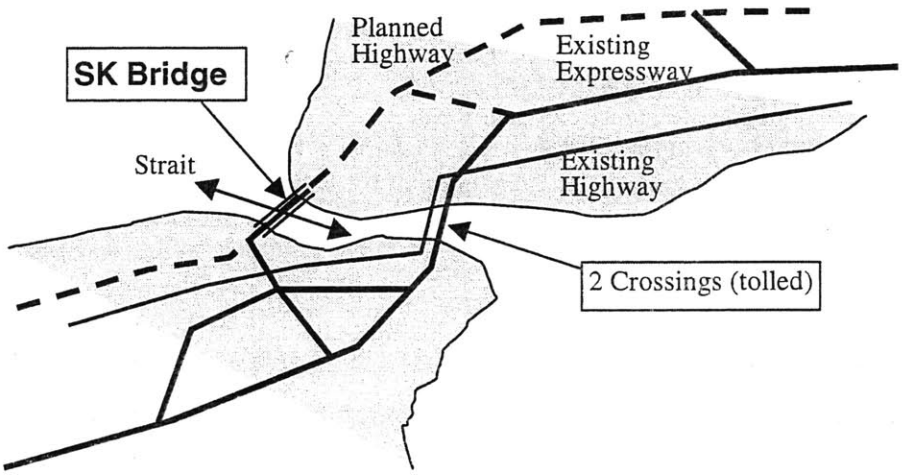


Figure 6-9 The SK Bridge and the Pertinent Network

(2) Assumptions for the Simulation

Assumptions for the simulation are primarily based on the preliminary report and as outlined in **Table 6-1**.

In the report, on which this simulation is based, the government subsidy of 20% of the construction cost is considered as well as the corporate tax. This simulation, however, ignores both the direct subsidy and the tax, for the two cancel out each other in present values according to the report.

Table 6-1 Assumptions for the Simulation of the SK Bridge Project

Items	Assumptions	Remarks
Project Scope	Bridge Portion: The Private Sector (PFI) Access Roads Portion: The Public Sector	
Project Cost	Total: ¥104 billion PFI: ¥80 billion construction cost Pre-Construction Cost: 5% of the construction cost	Construction cost is for Base Case
Construction Period	4 years	
Construction Cost Ratio for Each Year	20%, 30%, 30%, 20%	
Concession Term	30 years, including 4-year construction period	
Traffic Volume and Toll Revenue	22,500 vehicle/day, ¥600 for a passenger car, at Commencement, Revenue of ¥5,000 million in the first year, 3.5% annual increase	
Operation and Maintenance Costs	According to the JH Standard 2.7% annual increase in cost	
Equity Ratio	20% of the PFI portion	Base Case
Senior Debt	Project Finance: 15-year term, 5.1% interest, 15-year amortization	From Commencement
Reserve Funds	Twice as much as the annuity of the bond	With 4% interest bearing
Subordinated Debt	Project Finance: 26-year term, 6% interest	Subordinated to Senior debts and Reserve Funds
Corporate Tax	Exempted	As the policy of the equal footing or as a governmental subsidy
Depreciation	Neglected	Negligible because it is not necessary to calculate the taxes
Dividends Distribution	After the completion of the debt service	
Discount Rate	4%	

6.2.2. Application of the PFI Toll Bridge Framework

(1) Potential Feasibility

The SK Bridge project has a considerable potential with regard to the feasibility as a PFI project. Although the uncertainty of the traffic volume affects the financial feasibility and residential objection may occur, potential advantages predominate, such as efficient planning and design and early operation. For example, since the bridge will span a strait that has strong currents, in which the foundations must be set, the private

sector's know-how and experiences are essential for the secure construction work of one of the largest, most complicated bridge projects in Japan. Eventually, technical studies are in progress with the goal of 30% cost-reduction of the project from the present estimation. Challenges involved in the project in cost and time reduction supposedly lead technological innovations and scale merits. The scale of the project is quite large and requires huge finance to implement the project. This entails the necessity of private finance, another potential to favor the PFI.

(2) Organization Structure and Government's Responsibility

The organizational structure for the SK Bridge project is presumably as shown in **Figure 6-10**, which is basically the same as the one suggested in Chapter 5. The national government will establish an authorized agency that is responsible for defining the scope, establishing the PFI scheme, evaluating the private consortia's proposals, issuing permissions and agreements, and overseeing the operation. In defining the scope, the government should not specify details; rather, it should give the private sector a broad flexibility so that the private sector can make the most of their creativity and the potential (See **Figure 5-8**). For instance, the precise alignment should be left flexible and so should other structural specifications, so that the private sector may seek the most efficient combination of the structure and the alignment to take advantage of their differentiated technologies or equipment. Furthermore, the private sector may adopt the best mix of project's performance and its cost in order to maximize the profitability of the project and the benefits to the public.

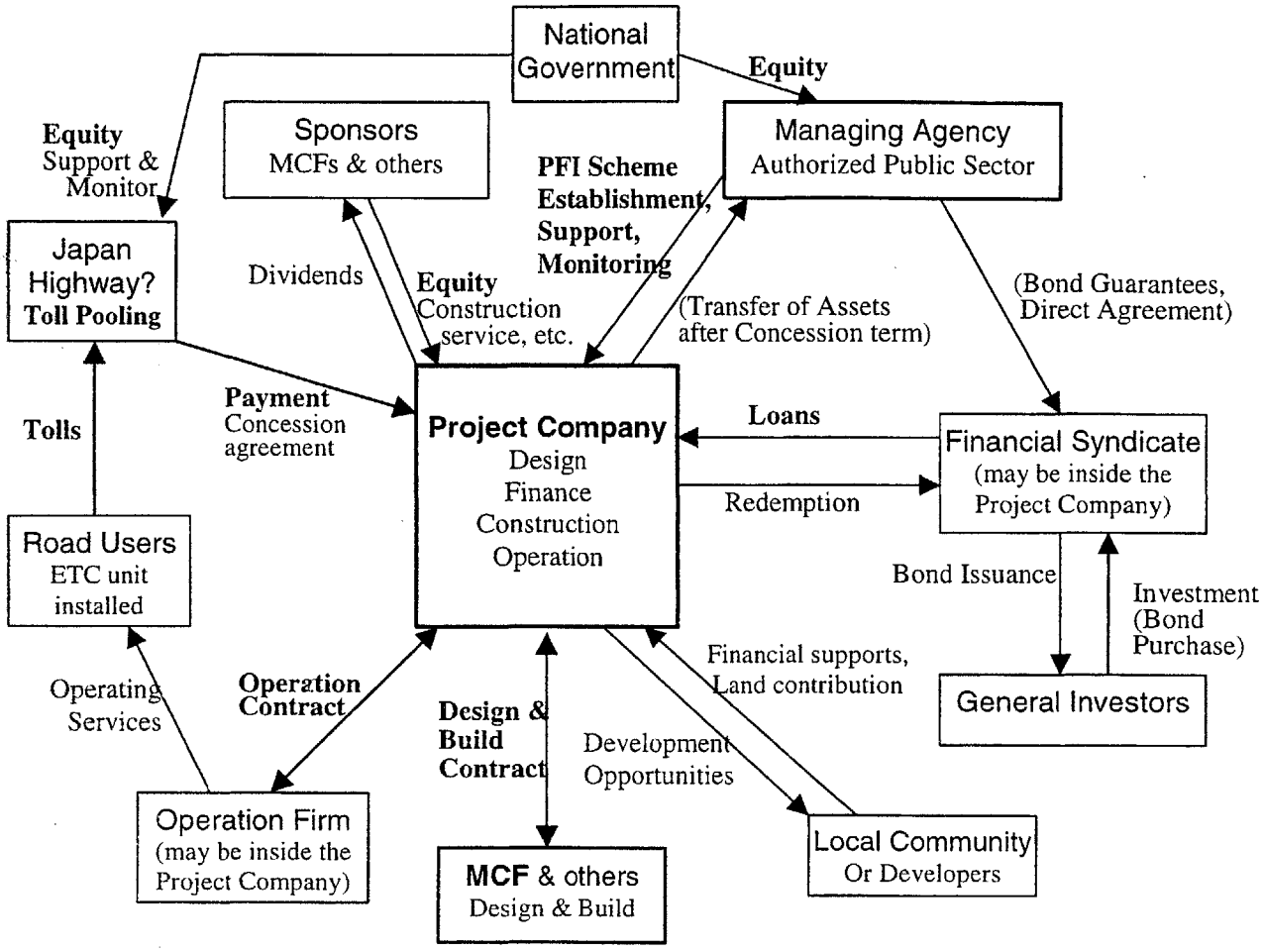


Figure 6-10 Prospective Organizational Structure for the SK Bridge Project

(3) Cash Flow Simulation of the Project

In order to test the framework with respect to: 1) the influence of the private sector's efficiency with construction cost reduction, 2) the advantage of utilizing the governmental bank to bring in a low rate of a subordinated loan, 3) the effectiveness of hedging the traffic volume risk by setting a minimum floor level or adopting a shadow toll system, and 4) the merit of introducing a public capital market to attract general investors, cash flow simulations were executed based on the general assumptions shown earlier in **Table 6-1** and other case-specific assumptions described in **Table 6-2**. "Original Case" is most largely based on the preliminary report of the project with altering some numbers and subsidy/tax features. Case 1 is intended to demonstrate the effectiveness of private sector's efficiency and of the utilization of low interest (3%) subordinated debt borrowed from the ***Development Bank of Japan (DBJ***, a

governmental bank).[10] Cases 2 and 3 look at the sensitivity of the construction cost and the traffic volume, respectively, to the overall profitability of the project. Larger equity in Case 4 means either the availability of the public investment in the project or the sponsors' willingness to be more involved in the project.

The results of the simulations are summarized in **Table 6-2**. In addition, an example of the spreadsheet to produce the cash flows and the graphs of financial results of each case are presented in **Appendix B**. The profitability of the project and the availability of the loans are evaluated with the numbers of Equity IRR (ROE), DSCR (loan life), and NPV. The thresholds of these numbers for the successful implementation of the SK Bridge project are 6% (recommendation of the preliminary report, considering current financial environment in Japan), 1.5 (generally recognized as sufficient in Japan, depending on the risk profile), and positive (by definition), respectively. Minimum annual DSCR is also shown as an additional index, which must be more than 1.0, considered in the whole revenue stream of the project.

[10] Current interest rates of 20-year loans with a 3-year deferment period are set at 1.8-2.1% in the case of the annuity repayment method. A little higher rate is set in this simulation because of the subordinated feature.

Table 6-2 Summary of the Simulations of the PFI Framework

	Original Case	Case 1 Base Case	Case 2	Case 3	Case 4
Conditions	11.1% Higher Construction Cost and 6.0% Interest on Subordinate Debt	Following the suggested PFI Framework, Utilize DBJ's 3% Subordinate Loan	25% Construction Cost Overrun	20% Lower Traffic Volume	Larger Equity (40%, Base: 20%)
Construction Cost (¥ million)	**¥80,000**	¥72,000	**¥90,000**	¥72,000	¥72,000
Senior Loan (ratio, amount in ¥ million, interest rate)	40% ¥32,000 5.1%	40% ¥28,800 5.1%	32% ¥28,800 5.1%	40% ¥28,800 5.1%	**30%** **¥21,600** 5.1%
Subordinate Loan (ratio, amount in ¥ million, interest rate)	40% ¥32,000 **6.0%**	40% ¥28,000 3.0%	32% ¥28,000 3.0%	40% ¥28,000 3.0%	**30%** **¥21,600** 3.0%
Equity (ratio, amount in ¥ million)	20% ¥16,000	20% ¥14,400	**36%** **¥32,400**	20% ¥14,400	**40%** **¥28,800**
Toll Revenue	Same as Base Case	Base Case	Same as Base Case	**80% of Base Case**	Same as Base Case
Main Results					
Equity IRR	Negative	6.90%	3.51%	2.36%	5.77%
(Loan-life) DSCR	1.50	1.70	1.72	1.28	2.29
Min. Annual DSCR	1.13	1.28	1.30	0.96	1.74
NPV (in ¥ millions)	–¥11,764	¥13,793	–¥3,496	–¥5,083	¥12,841
Comments	The original report shows a positive IRR of 6% with 20% government subsidy and 40% tax payment.	Compared to the Original Case, this case demonstrates the viability of the suggested PFI framework.	Since the contractor assumes the risk of construction cost overrun, this does not affect DSCR but affects ROE much.	Even severer traffic volume problem may ensue. Demand risk is the most crucial risk in this project.	Financing conditions should be more favorable because of better DSCR.

(4) Roles of the Government and the Private Sector

Case 1 assumes a construction cost reduction of 11.1% (from original ¥80,000 million to ¥72,000 million)[11] by making use of private sector's efficiency, together with the scale and the complexity of the project, which make the private sector's efficiency more likely. This case also assumes the availability of the low rate subordinated loan issued by the DBJ. As the preliminary report encourages setting the threshold of 6% for the Equity IRR (ROE), these improvements would make the project profitable enough. Also, the significant improvement of the DSCR (from 1.50 to 1.70) makes the project enable to finance and feasible. Therefore, a nominal financial support (providing low-rate subordinate loan) is, at least, essential to the implementation of the SK Bridge project.

The construction cost reduction is the responsibility of the MCF that participates in the PFI project to win the concession. This is a responsibility but not the additional (extra) contribution for which the MCF can ask compensation to the consortium.

(5) Other Government Supports – Risk Allocation

Cases 2 and 3 contrast the sensitivity of two risk factors: the construction cost overrun and the traffic volume. While a construction cost overrun would affect the profitability (E-IRR) of the project only when the cost significantly exceeds the estimated figure (25% excess in Case 2, which is well above the prospective cost overrun in Japan), low traffic volume would affect both the profitability of the project and the stableness of the financing (DSCR) in a likely situation (20% lower than the estimation, which actually occurred in many projects, such as Tokyo Bay Aqua-Line project) much more than the cost overrun would. The traffic volume risk is thus crucial in the SK Bridge project, and some risk mitigation measures are necessary for the project company.

Minimum traffic or revenue guarantee, shadow tolls, and revenue enhancements (such as availability fees, exclusivity guarantees, and utilization of the revenue from the other crossings) can be the alternative measures for the risk allocation according to the framework suggested in Chapter 5. Although the influences of these alternatives are not simulated here, the necessity and the effectiveness are obvious, regarding the high

[11] This figure (11.1% reduction) is reasonable enough, considering that an ongoing technical study is aimed at achieving 30% cost reduction, as noted earlier, and that experiences show the potential of construction cost reduction if the project is large and technically complicated. For example, Section 4.2.10 shows 10% cost reduction case for much smaller scale project.

sensitivity of the traffic volume risk. Moreover, these alternatives should be acceptable to the government as well. For example, a minimum revenue guarantee contract, combined with the ceiling setting suggested in the framework, may benefit the government if the traffic exceeds the ceiling level with the same level of the probability of losing money for the guarantee, provided that the traffic projection is reasonable. The combination pricing of shadow tolls and real tolls may work as a sensitivity absorber because the shadow tolls are paid relatively more in the worse scenarios. An exclusivity guarantee and the utilization of the revenue from the other crossings should be also considered so that the competitive routes would not deteriorate the proposed project.

(6) Utilization of the Capital Market

In order to simulate the effects of the utilization of the capital market, which is also suggested in Chapter 5, Case 4 raises the ratio of the equity to finance the project. The case assumes that the stock of the project company is exchanged in the public capital market and that the company obtains more stockholders from the market, so the debt burden would be reduced. The result shows the significant improvement in the DSCR from 1.70 in Case 1 to 2.29 in Case 4, while the E-IRR loses 1.13% (from 6.90% to 5.77%) due to the heavy investment although net profits to the project company become larger and earlier.

Investors, in actuality, prefer bonds or preferred stocks, from which coupons or dividends proceed earlier and more securely, rather than the common stock, which may be difficult to trade in the early stage of the operation in the cases of long-life infrastructure projects such as toll roads (See **Figure 5-11**). Therefore, the result of Case 4 should be viewed from the lenders' perspective (such as DSCR) rather than the investors' (such as E-IRR). By the utilization of the public capital market, as the financial institutions can reduce the magnitude of the loans to the project, the DSCR would be improved and thus the financial institutions could offer more favorable, or lower, interest rates on the senior loans or bonds. Taking into account the additional effects and lowered equity ratio (substituted by preferred stocks), the profitability of the project (E-IRR) would be also improved. The effectiveness of lowered interest rates is demonstrated shortly in this section.

6.2.3. Application of the MCF's Strategies

(1) Cash Flow Simulations for the SK Bridge Project

Following the previous simulations that demonstrate the viability of the PFI framework for toll road/bridge/tunnel projects, the rest of the simulations analyze how the MCF's strategies, developed in the former section in this chapter, work in the context of the PFI toll bridge project with the example of the SK Bridge project. Cases in the simulation and the summary of their results are shown in **Table 6-3** and **Appendix B**.

Table 6-3 Summary of the Simulations of the MCF's Strategies

	Case 1 Base Case	**Case 5**	**Case 6a**	**Case 6b**
Conditions	Following the suggested PFI Framework	1.5% Lower Senior Bonds Interest Rate	MCF's Cost Reduction **w/o exercising S.O.**	MCF's Cost Reduction **with exercising S.O.**
Construction Cost (¥ million)	¥72,000	¥72,000	¥68,000 (¥64,000-actual)	¥68,000 (¥64,000-actual)
Senior Loan (ratio, amount in ¥ million, interest rate)	40% ¥28,800 5.1%	40% ¥28,800 **3.6%**	36.5% ¥24,800 **3.6%**	36.5%→30.6% ¥24,800→¥20,800 **3.6%**
Subordinate Loan (ratio, amount in ¥ million, interest rate)	40% ¥28,800 3.0%	40% ¥28,800 3.0%	42.4% ¥28,800 3.0%	42.4% ¥28,800 3.0%
Equity (ratio, amount in ¥ million)	20% ¥14,400	20% ¥14,400	21.2% ¥14,400	21.2%→27.1% ¥14,400→¥18,400
Toll Revenue	Base Case	Same as Base Case	Same as Base Case	Same as Base Case
Main Results				
Equity IRR	6.90%	7.49%	7.76%	6.87% −Value of the Stock Option
(Loan-life) DSCR	1.70	1.71	1.84	1.83
Min. Annual DSCR	1.28	1.44	1.67	1.96
NPV (in ¥ millions)	¥13,793	¥17,017	¥18,571	¥1,951 −Value of the Stock Option
Comments	Compared to the Original Case, this case demonstrates the viability of the suggested PFI framework.	Lower interest rate has a moderate impact on the profitability of the project.	**The MCF obtains ¥4,000 million in cash at the end of Construction.**	The MCF's Stock Option has a value of ¥5,951 million (¥4,000 million in cash plus the NPV above).

In Case 5, the interest rate of the senior loan is lowered to reflect more favorable credit rating of the project company that has differentiated advantages, such as better financial strength and better structural scheme of the project. Case 6a assumes that the MCF utilizes their special technologies, patents, or equipment and succeeds in significant cost reduction. Case 6a further assumes that the MCF does not exercise the stock option in the "GMP and SO" contract proposed in Section 6.1.2 (4), while Case 6b considers exercising the stock option (Note again that "stock option" here is not necessarily same as that generally used in the current business practice).

(2) Effects of the Differentiation Strategy

The MCF's competitive differentiation strategy may have effects on the project profitability in several ways. If the MCF differentiates itself by the robust financial status, the financial institutions that issue the bonds or loans for the project company, which the MCF sponsors for a substantial portion, may be willing to offer lower interest rates than for other consortia or the project structured by other consortia. For instance, as noted earlier, the financial institution would set 100-150 basis points lower interest rates for AAA-rated company bonds, compared to BBB-rated company bonds.

If a technological advantage to the project or special equipment used for the project is the differentiation of the MCF, the MCF should make the most use of the differentiation by efficiently reducing the construction cost of the project. The credibility of the MCF to complete the construction work backed by the technological advantage also should reduce the risk premium, or the interest rates of the loans.

Case 5 in the simulation reflects these differentiation factors and adopts a 1.5% lower interest rate on the senior bonds and loans. In the case of the SK Bridge project, this improves Equity IRR by 0.59%, DSCR by 0.01 point, and minimum annual DSCR by 0.16 point. If the differentiation makes possible the cost reduction of ¥4,000 million, in addition to the ¥8,000 million reduction as a PFI project, Case 6a shows the effect of the additional cost reduction. Namely, the cost reduction results in the improvement of additional 0.27% Equity IRR, 0.13 point in DSCR, and 0.23 point in minimum annual DSCR.

(3) Effects of the Equity Contribution Strategy

As already seen in Case 4, larger equity has a significant effect on the DSCR (from 1.70 in Base Case to 2.29 in Case 4), which may contribute to lowering the interest rates of the debt. Although this figure may attract the third party investors as equity holders, lowered Equity IRR due to the heavier equity amount would distract the MCF from the equity contribution strategy. It is essential for the MCF to have an elaborate strategy to benefit from its differentiated competitive advantages. For example, if additional equity contribution is relatively small enough not to deteriorate the Equity IRR, the equity contribution strategy may be reasonable, together with considering utility function concept and portfolio management. "GMP and SO" contract is another alternative to bring effect the equity contribution strategy.

(4) Effectiveness of "GMP and SO" Contract

One of the schemes for the MCF to take advantage of its competitive differentiation is "GMP and SO" contract. Case 6a and Case 6b demonstrate the effectiveness. Both cases assume that the MCF and the project company agree on a "GMP and SO" contract and set the GMP of ¥72,000 million, which is the competitive price as the PFI. The contract includes a provision that a half of the difference between the GMP and the settlement price should go to the project company's account to immediately repay the senior loans, provided the settlement price is lower than the GMP, and that the MCF completes the construction work in ¥64,000 million, or with 11.1% cost reduction, utilizing the MCF's competitive differentiation. Both cases use the same interest rates on debt as Case 5. Case 6a illustrates the case in which a simple GMP contract is adopted, or the MCF does not exercise the right to purchase the stock of the project company, while Case 6b assumes the MCF does exercise the stock option and replace the senior loans with the additional equity.

In Case 6a, not only does the project company earn the improved Equity IRR of 7.76% compared to Case 5 (7.49%), but also, and more importantly, the MCF earns additional ¥4,000 million in cash at the completion of the construction, without exercising the stock option. This feature, benefiting from the construction, is the very business of the MCF, but it does not yet seem to be equitable enough to the MCF's competitive differentiation, which reduces the construction cost by ¥8,000 million.

Case 6b is the case in which further profits to the MCF is sought. If the MCF exercises the stock option in full, which replaces a portion of the senior loans, the additional profits to the project company (by the early repayment of the senior loans) accounts for ¥1,951 million and the Equity IRR of the early repayment is 6.87%. Minimum annual DSCR is also improved significantly. Moreover, the MCF may exercise the stock option and sell the additional stock with the margin of ¥1,951 million or more if the net worth of the project company grows because of the successful completion. This is likely the case if the completion risk is the crucial risk factor. The MCF may retain the stock option partially if it prefer more cash, or may invest more aggressively from the beginning of the project if it is confident enough for the successful completion.

In sum, the equity contribution strategy, by way of GMP and SO contract, for example, has a substantial potential to benefit the MCF. It should be noted, however, that the MCF needs to have a competitive differentiation that makes the project more profitable than the competitive level as the PFI.

Chapter 7. Conclusion

In order to identify the Japanese PFI framework and to develop the MCF's strategies for the PFI through a specific type of project, i.e., a toll road/bridge/tunnel project, this thesis examines the Japanese construction industry in Chapter 2 (and others) and introduces the Japanese PFI in Chapter 3, as the background. Chapter 4 analyzes some ten case studies relevant to the toll road/bridge/tunnel project or the Japanese PFI. Based on the background and the findings from the case studies, Chapter 5 develops a framework for prospective toll road/bridge/tunnel projects utilizing the Japanese PFI scheme, with regard to the viable types of projects and desired project structure, including governments' financial supports and risk sharing. Expectations of the dissemination of the PFI are also addressed in Chapter 5 in the context of the Japanese economy and the construction industry in Japan. Chapter 6 proposes two strategies for a Japanese MCF to face the PFI: differentiation and equity contribution strategies. Finally, simulations are applied to a prospective toll bridge project to test the viability of the framework and the strategies developed in Chapter 5 and proposed in Chapter 6, respectively. Through the process above, this thesis reached the following four main conclusions.

Conclusion 1. The MCF's roles are important, and its potentials are huge in the Japanese PFI

Most project companies in the case studies are led by an MCF. MCFs play crucial roles in the projects, especially new road/bridge/tunnel construction projects such as in the Kurushima Kaikyo Bridge, the Tokyo Bay Aqua-Line, the Confederation Bridge, Sydney Harbour Tunnel, and some of U.K.'s DBFO road projects as observed in Chapter 4. Many technically complicated projects would not have been realized had the MCFs

not played crucial roles in developing the projects. More importantly, in some foreign private toll road/bridge/tunnel cases, such as the Confederation Bridge, the Sydney Harbour Tunnel, and SR57, the MCFs overcame the strict limitation of the governments' financial supports with original technologies or equipment.

Conclusion 2. A real public-private partnership to implement the Japanese PFI is essential to the development of a toll road/bridge/tunnel project.

A real public-private partnership, which implies joint efforts and initiatives of the public and private sectors with eagerness to implement the Japanese PFI, is essential to the development of projects such as the toll road/bridge/tunnel project. Governments play the most important roles in encouraging the private sector to be involved in the projects, for example, by sending a clear signal to express the necessity of the project. Provided that the government is committed to developing a project, the MCF should have strong incentive to participate in the project and even lead a prospective project company. This thesis develops a framework in Chapter 5 (Section 5.4), which suggests viable project types and desirable project structures (organizational structures, project selections, scope establishments, governments' financial supports, tolling systems, and the utilization of the capital market). This framework should help the development of a Japanese PFI project, specifically for a toll road/bridge/tunnel project, if the real public-private partnership is established.

Conclusion 3. Having realized the importance and potential of its roles, the MCF should think about investment and competition strategies for the Japanese PFI.

As mentioned in Conclusion 1, MCFs often play the critical roles in developing technically complicated projects. The MCFs therefore deserve a substantial portion of the benefits the projects generate. From Japanese MCFs' standpoint, this thesis proposes two generic strategies: differentiation and equity contribution, in Chapter 6 (Section 6.1). Robust financial status, specialized talent and experiences, differentiated technologies and patents, and proper equipment exemplify the competitive differentiation. Under certain important conditions, for instance if all risks except the completion risk are well

mitigated or transferred, or if the project includes a large potential to develop innovative construction means, MCFs could manage the project risk to a substantial extent, and then, should consider the investment strategy, namely, equity contribution. This thesis proposes a reasonable method of investment, "a GMP and SO (stock option)" contract, and provides simulations in Chapter 6 (Section 6.2) to show its viability among others. The "GMP and SO" contract includes the potential of more profits for the MCF and a more sound financial scheme for the project company and financiers.

Conclusion 4. The Japanese PFI has a substantial potential to improve the public facilities procurement and MCFs should play important roles in it.

Coupled with the circumstance of the Japanese economy and the trends of the Japanese construction industry, the Japanese PFI has substantial potential to improve the public facilities and services procurement, and the expectation of its dissemination is considerable as observed in Chapter 5 (Section 5.1). MCFs should play important roles in the new procurement system by exercising their potentials, by developing the partnership with the governments, and by exploiting the strategies, as described in Conclusions 1 through 3, respectively.

Appendix A. Currency Rate Chart

The following currency rate chart, as of March 31, 2001, is provided for the purpose of convenience only. In this chart, for example,

US$1 = ¥ 126.25 = EUR1.1494 = C$1.5761 = £0.7061 =A$2.0602.

Table A-1 Currency Rate Chart

As of March 31, 2001

	¥	US$	EUR	C$	£	A$
Japanese Yen	100	0.7921	0.9104	1.2484	0.5593	1.6318
U.S. Dollar	126.25	1	1.1494	1.5761	0.7061	2.0602
Euro	109.84	0.8700	1	1.3712	0.6143	1.7923
Canadian Dollar	80.103	0.6345	0.7293	1	0.4480	1.3071
British Pound	178.81	1.4163	1.6279	2.2322	1	2.9178
Australian Dollar	61.282	0.4854	0.5579	0.7650	0.3427	1

Appendix B. Simulation Worksheets

SK Bridge by Japanese PFI

Case 1 (Base) On the Basis of Suggested Framework and Expectation

Controls & Assumptions:	¥ million
Senior Bonds and Loans	40%
Subordinate Debts	40%
Equity Contributions	20%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Construction Cost of the Project	¥72,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Interest Rate on Bonds issued	5.1%
Term of Bonds (year)	15
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Interest Rate on Subordinate Debt from DBJ	3.0%
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Cash Flows ¥ million

	(Total)	(PV)	Year 0	1	2	3	4
Sources							
Senior Bonds	¥32,155	¥29,287	¥1,697	¥5,815	¥8,883	¥9,171	¥6,588
Subordinate Debt	¥32,155	¥29,287	¥1,697	¥5,815	¥8,883	¥9,171	¥6,588
Equity	¥16,078	¥14,643	¥849	¥2,907	¥4,442	¥4,586	¥3,294
Toll Revenues	¥206,566	¥100,670	¥0	¥0	¥0	¥0	¥0
Interest on Rsrv Fd.	¥5,668	¥3,242					
Total Sources	**¥292,622**	¥176,658	¥4,243	¥14,537	¥22,208	¥22,928	¥16,471
Uses							
Pre-constr. Costs	¥3,600	¥3,600	¥3,600				
Bonds Issue Costs	¥643	¥643	¥643				
Construction Costs	¥72,000	¥65,328		¥14,400	¥21,600	¥21,600	¥14,400
Intrt on Bond in Constr.	¥2,610	¥2,295		¥87	¥383	¥836	¥1,304
Intrt on DBJ Ln in Constr	¥1,535	¥1,350		¥51	¥225	¥492	¥767
Total Uses In Constr	**¥80,388**	¥73,217	¥4,243	¥14,537	¥22,208	¥22,928	¥16,471
O&M Expense +VAT	¥37,003	¥21,458					
Net Oprtn.Income	¥175,230	**¥99,553**					
Bonds Annual Pay't	¥46,783	¥34,677					
Bonds Outstanding			¥1,697	¥7,512	¥16,396	¥25,567	¥32,155
Reserve Funds	¥6,238	¥5,492					
Reserve Funds -Cum.							
DBJ Debt Service	¥47,559	¥28,367					
DBJ Outstanding			¥1,697	¥7,512	¥16,396	¥25,567	¥32,155
Equity Investments	**¥64,810**	**NPV ¥13,793**	(¥849)	(¥2,907)	(¥4,442)	(¥4,586)	(¥3,294)

Discounted at 4.0%

DSCR (Project, All Loan: 1.70

Equity IRR (ROE) **6.90%**

Minimum Annual DSCR 1.28

Year	5	6	7	8	9	10	11	12	13	14	15	16	17
Toll Revenues	¥5,000	¥5 175	¥5,356	¥5,544	¥5,738	¥5,938	¥6,146	¥6,361	¥6,584	¥6,814	¥7,053	¥7,300	¥7,555
Interest on Rsrv Fd	¥0	¥35	¥78	¥128	¥187	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250
Total Sources	¥5,000	¥5,210	¥5,434	¥5,672	¥5,925	¥6,188	¥6,396	¥6,611	¥6,834	¥7,064	¥7,303	¥7,549	¥7,805
O&M Expenses	¥1,000	¥1,027	¥1,055	¥1,083	¥1,112	¥1,142	¥1,173	¥1,205	¥1,238	¥1,271	¥1,305	¥1,341	¥1,377
Net Oprt. Income	¥4,000	¥4,183	¥4,379	¥4,589	¥4,812	¥5,045	¥5,222	¥5,406	¥5,596	¥5,793	¥5,997	¥6,209	¥6,428
Bonds Annual Pay't	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119	¥3,119
Bonds Outstanding	¥30,676	¥29,122	¥27,488	¥25,771	¥23,967	¥22,070	¥20,077	¥17,982	¥15,780	¥13,466	¥11,034	¥8,478	¥5,791
Reserve Funds	¥881	¥1,064	¥1,260	¥1,470	¥1,562	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0
Reserve Funds -Cum.	¥881	¥1,945	¥3,206	¥4,676	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238
DBJ Loan Debt	¥0	¥0	¥0	¥0	¥131	¥1,927	¥2,104	¥2,287	¥2,477	¥2,674	¥2,878	¥3,090	¥3,309
DBJ Loan Outstanding	¥33,120	¥34,113	¥35,137	¥36,191	¥37,146	¥36,333	¥35,320	¥34,092	¥32,638	¥30,943	¥28,993	¥26,773	¥24,267
Equity Dividends	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0
Minimum Annl. DSCR	1.28	1.34	1.40	1.47	1.54	1.62	1.67	1.73	1.79	1.86	1.92	1.99	2.06

Year	18	19	20	21	22	23	24	25	26	27	28	29	30
Toll Revenues	¥7,820	¥8,093	¥8,377	¥8,670	¥8,973	¥9,287	¥9,613	¥9,949	¥10,297	¥10,658	¥11,031	¥11,417	¥11,816
Interest on Rsrv Fd	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250	¥250
Total Sources	¥8,069	¥8,343	¥8,626	¥8,919	¥9,223	¥9,537	¥9,862	¥10,198	¥10,547	¥10,907	¥11,280	¥11,666	¥12,066
O&M Expenses	¥1,414	¥1,452	¥1,491	¥1,532	¥1,573	¥1,615	¥1,659	¥1,704	¥1,750	¥1,797	¥1,846	¥1,895	¥1,947
Net Oprt. Income	¥6,655	¥6,891	¥7,135	¥7,388	¥7,650	¥7,922	¥8,203	¥8,495	¥8,797	¥9,110	¥9,435	¥9,771	¥10,119
Bonds Annual Pay't	¥3,119	¥3,119											
Bonds Outstanding	¥2,968	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)	(¥0)
Reserve Funds	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0
Reserve Funds -Cum.	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238	¥6,238
DBJ Loan Debt	¥3,537	¥3,772	¥7,135	¥7,388	¥4,851	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0
DBJ Loan Outstanding	¥21,458	¥18,330	¥11,745	¥4,709	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0	¥0
Equity Dividends	¥0	¥0	¥0	¥0	¥2,799	¥7,922	¥8,203	¥8,495	¥8,797	¥9,110	¥9,435	¥9,771	¥16,357
Minimum Annl. DSCR	2.13	2.21											

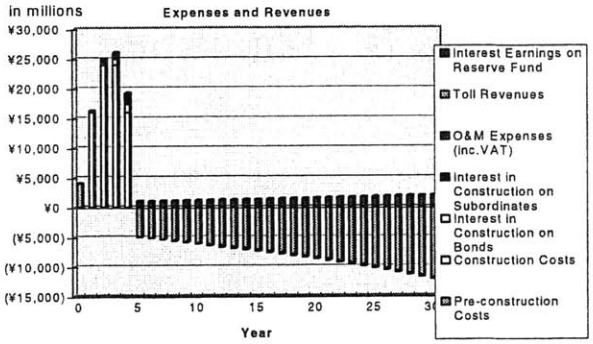
SK Bridge by Japanese PFI

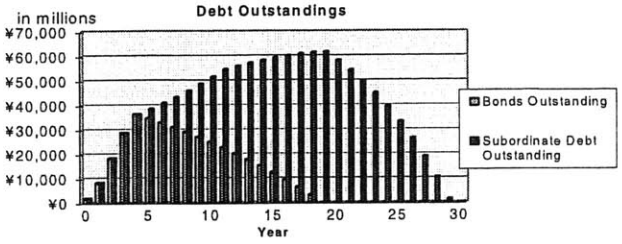
Original Case

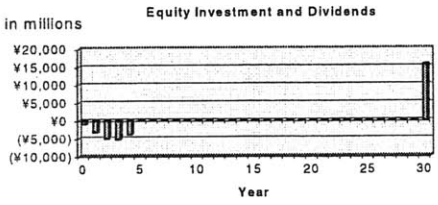
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥80,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	40%
	¥32,000
Term of Bonds (year)	15
Interest Rate on Bonds issued	5.1%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	40%
	¥32,000
Interest Rate on Subordinate Debt from DBJ	6.0%
Equity Contributions	20%
	¥16,000
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	#DIV/0!
DSCR (Project, All Loans)	1.50
Minimum Annual DSCR	1.13
NPV	(¥11,764)







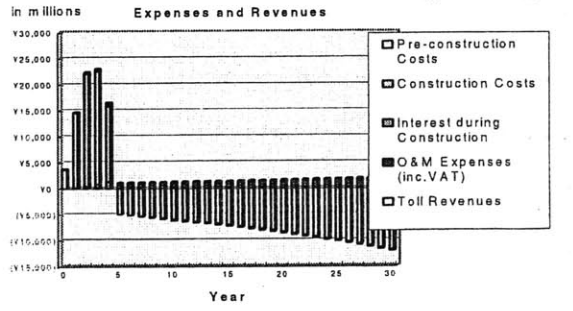
SK Bridge by Japanese PFI

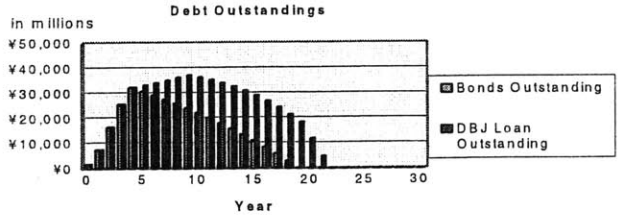
Case 1 (Base)

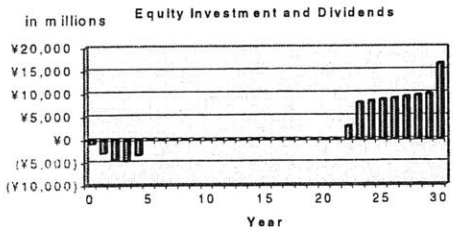
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥72,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	40%
	¥28,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	5.1%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	40%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	20%
	¥14,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	6.90%
DSCR (Project, All Loans)	1.70
Minimum Annual DSCR	1.28
NPV	¥13,793







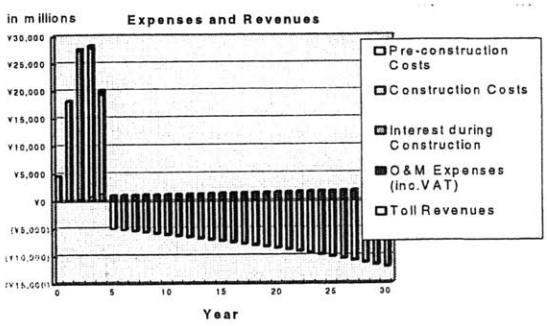
SK Bridge by Japanese PFI

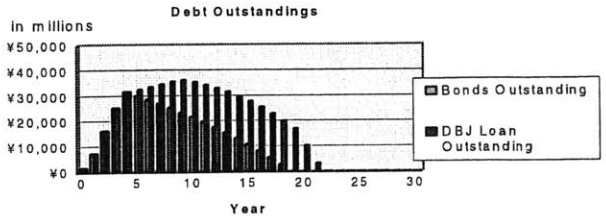
Case 2 (Construction Cost Overrun)

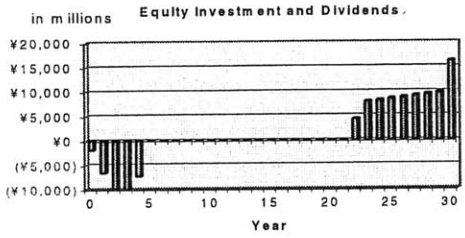
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥90,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	32%
	¥28,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	5.1%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	32%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	36%
	¥32,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	3.51%
DSCR (Project, All Loans)	1.72
Minimum Annual DSCR	1.30
NPV	(¥3,496)







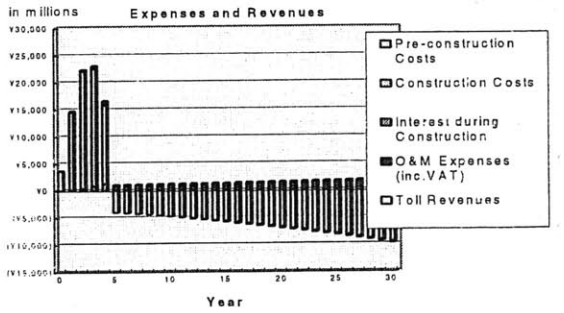
SK Bridge by Japanese PFI

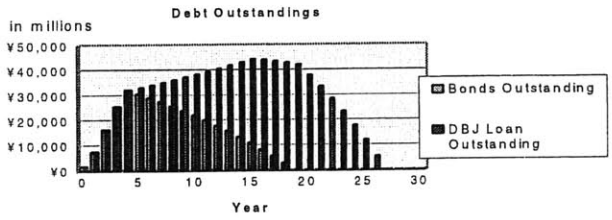
Case 3 (Low Traffice)

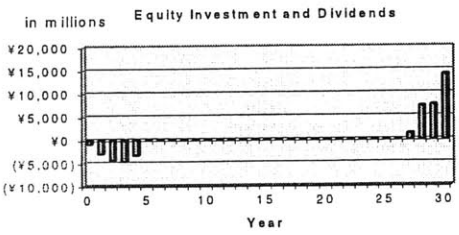
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥72,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥4,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	40%
	¥28,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	5.1%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	40%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	20%
	¥14,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	2.36%
DSCR (Project, All Loans)	1.28
Minimum Annual DSCR	0.96
NPV	(¥5,083)





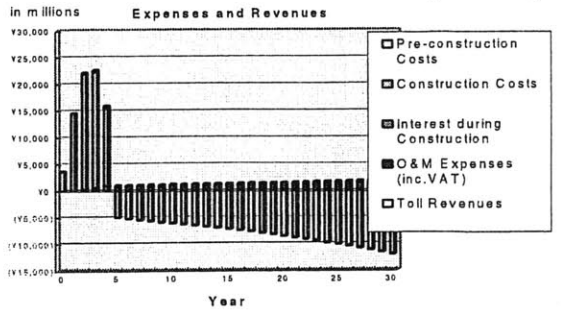


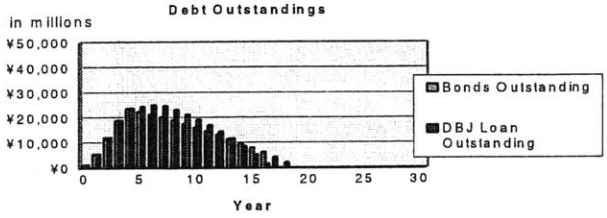
SK Bridge by Japanese PFI
Case 4 (Larger Equity)

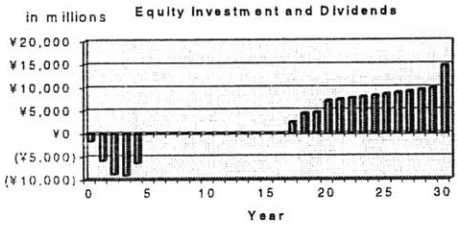
	¥ million
Controls & Assumptions:	
Construction Cost of the Project	¥72,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	30%
	¥21,600
Term of Bonds (year)	15
Interest Rate on Bonds issued	5.1%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	30%
	¥21,600
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	40%
	¥28,800
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	5.77%
DSCR (Project, All Loans)	2.29
Minimum Annual DSCR	1.74
NPV	¥12,841





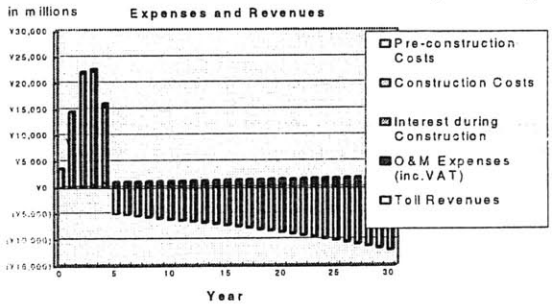


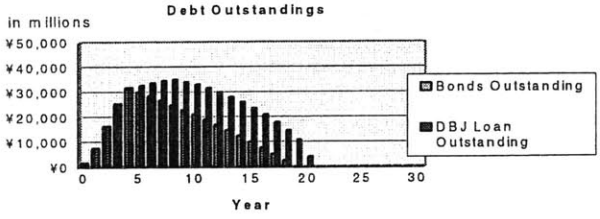
SK Bridge by Japanese PFI
Case 5 (Low Interest)

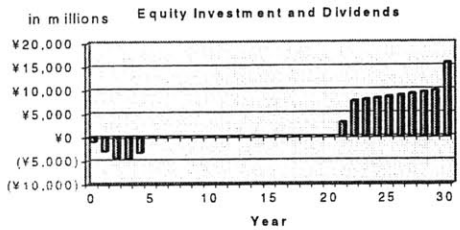
	¥ million
Controls & Assumptions:	
Construction Cost of the Project	¥72,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	40%
	¥28,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	3.6%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	40%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	20%
	¥14,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	7.49%
DSCR (Project, All Loans)	1.71
Minimum Annual DSCR	1.44
NPV	¥17,017







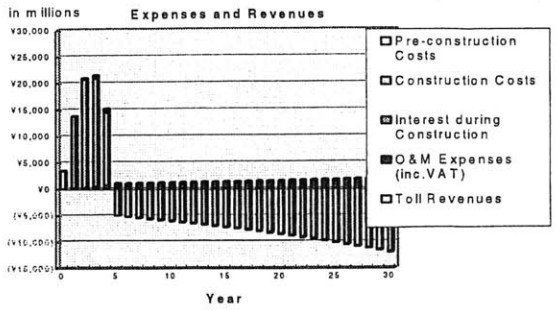
SK Bridge by Japanese PFI

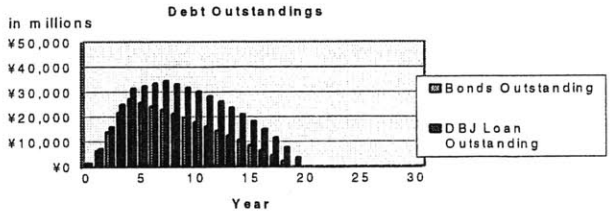
Case 6a (MCF's Strategy -1)

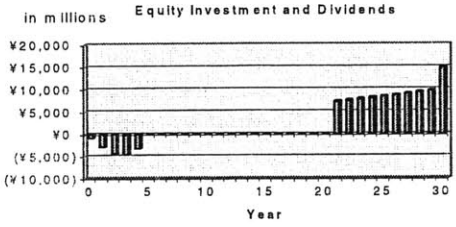
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥68,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	36%
	¥24,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	3.6%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	42%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	21%
	¥14,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
Equity IRR (ROE)	7.76%
DSCR (Project, All Loans)	1.84
Minimum Annual DSCR	1.67
NPV	¥18,571
Additional Profit at the end of Construction	¥4,000







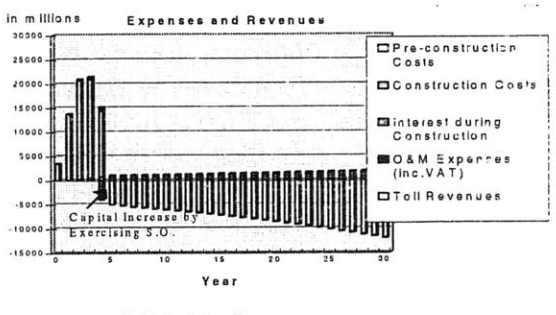
SK Bridge by Japanese PFI

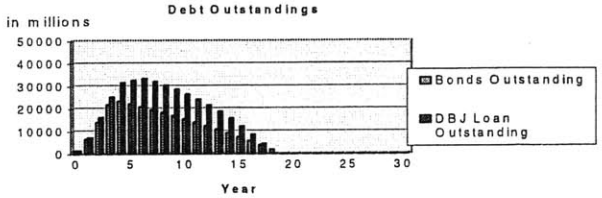
Case 6b (MCF's Strategy -2)

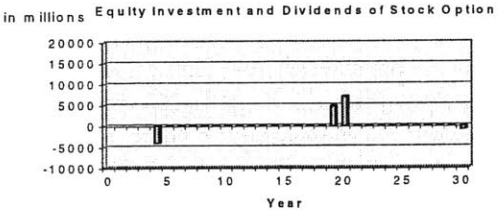
Controls & Assumptions:	¥ million
Construction Cost of the Project	¥68,000
Pre-Construction Costs (of Construction)	5%
Bonds Issue Costs (of Total Bonds)	2%
O&M Expenses in the 1st year	¥1,000
Annual increase in O&M	2.7%
Toll Revenue in First Year	¥5,000
Annual increase in Toll Revenue	3.5%
Senior Bonds and Loans	36%
	¥24,800
Term of Bonds (year)	15
Interest Rate on Bonds issued	3.6%
Reserve Funds (of Bonds annuity)	2.0
Interest Earning on Reserve Funds	4.0%
Subordinate Debts	42%
	¥28,800
Interest Rate on Subordinate Debt from DBJ	3.0%
Equity Contributions	21%
	¥14,400
Discount Rate	4.0%

Corporate Tax is exempted as an equal footing with PSC or as an equivalent with a subsidy.
Righ of Way Cost (¥6,000M) and costs for access roads (¥18,000M) are public responsibility.
Replacement&Renewals Fund is negligible

Main Results	
MCF can Exercise the Stock Option	
Equity IRR (ROE) of Stock Option	6.87%
NPV of Exercising the Stock Option	¥1,951
DSCR (Project, All Loans)	1.83
Minimum Annual DSCR	1.96
Additional Value of MCF's Stock Option	¥5,951







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